Electrical Contracting

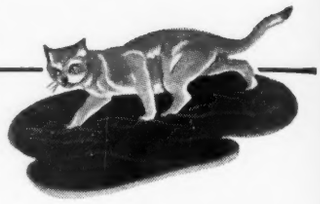
MAY · 1946

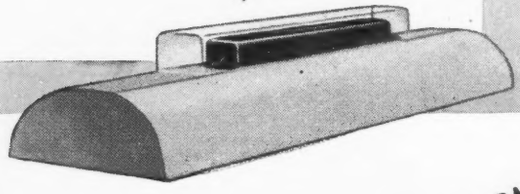
THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE

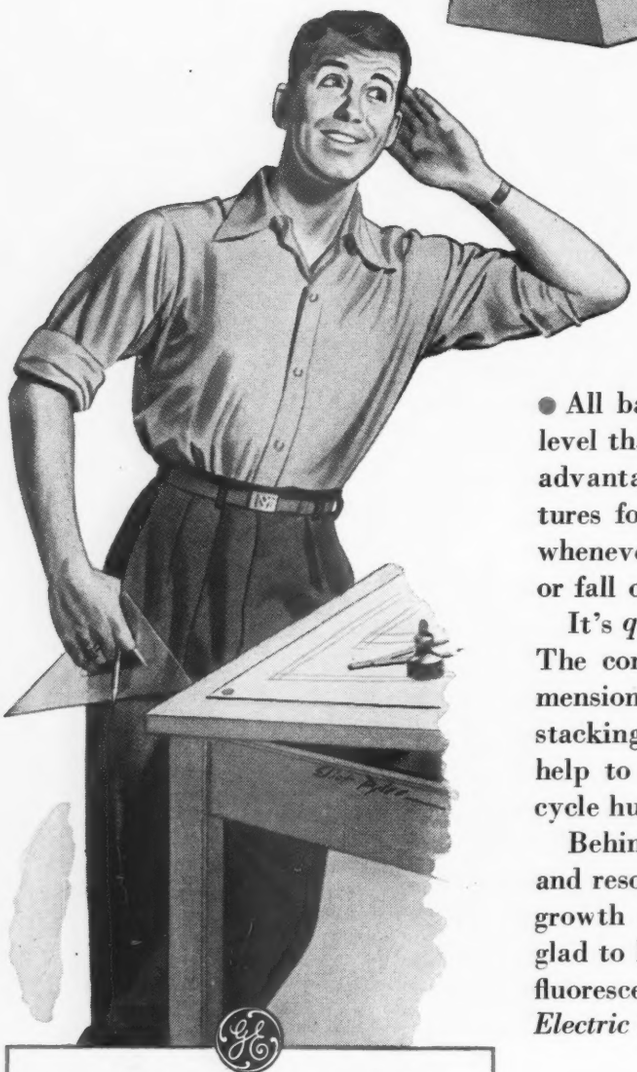
In This Issue . . .

wiring for the United Nations Security Council . . . skill credits for G. I.'s . . . type T wires stand severe service tests . . . training house wiremen . . . rewinding data for changing motor characteristics . . . more on industrial control . . . [illegible] many useful [illegible]

Quiet...
as a cat on velvet







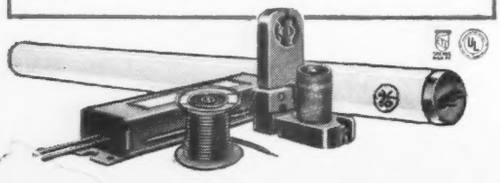
General Electric BALLASTS
HELP KEEP FIXTURE USERS SATISFIED . . .
THEY MEAN ADDED PROFITS FOR YOU!

● All ballasts hum, just as all cats purr; but a sound level that stays so low as to be unnoticeable is a major advantage of G-E ballasts. On fluorescent lighting fixtures for offices, hospitals, drafting rooms, studios, and whenever "quiet" is the rule, your reputation may stand or fall on this factor alone.

It's *quality construction* that keeps G-E ballasts quiet. The composition of the core steel, the accuracy of dimensions of the laminations, the uniformity of core stacking, the strength of the clamping structure—all help to make a cohesive unit tending to damp the 60-cycle hum.

Behind the design of G-E ballasts are all the research and resources which G.E. is concentrating on the steady growth of fluorescent lighting. Our engineers will be glad to help you select and apply ballasts or other G-E fluorescent fixture components. *Apparatus Dept., General Electric Co., Schenectady 5, New York.*

BALLASTS · LAMPS · STARTERS
LAMPHOLDERS · CABLE
for Dependability



1 Low noise level—for satisfied users

2 Long life—for low replacement cost

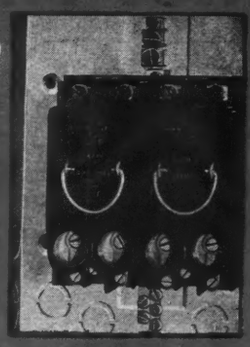
3 Characteristics matched with lamp—for rated lamp life and light output

4 Dimensions that permit use of one wiring channel for practically all fixtures—for simplified parts inventory and lower fixture cost

GENERAL ELECTRIC

.08-37-5205

"What switch," say you? These "PULL-OUTS", say contractors!



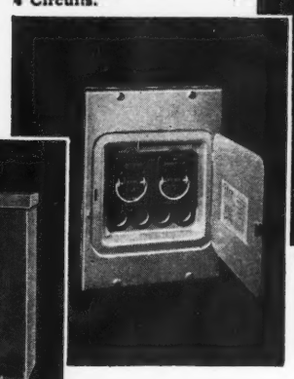
Cat. No. 258P
Metering equipment — Main and Range Switches.

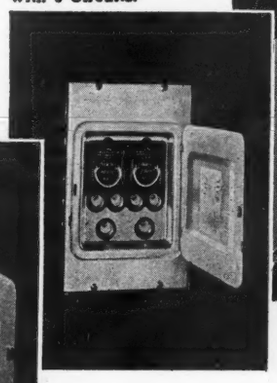
Cat. No. 74-6
60 amp. Main and Range Switches with 6 Circuits.

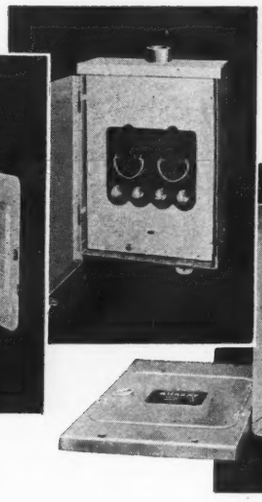
Cat. No. 52-4
60 amp. Outdoor Main and Range Switches with 4 Circuits.

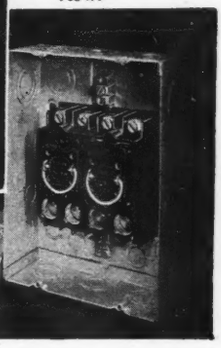
Cat No. 74-4
60 amp. Main and Range Switch, with 4 Circuits.

Cat. No. 74-4
Interior — Solderless Connectors in View.

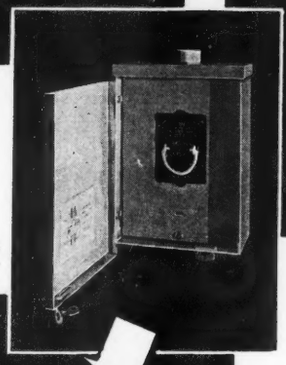


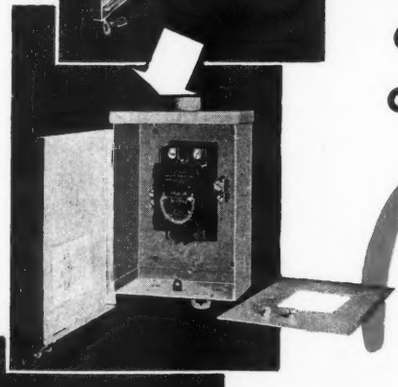


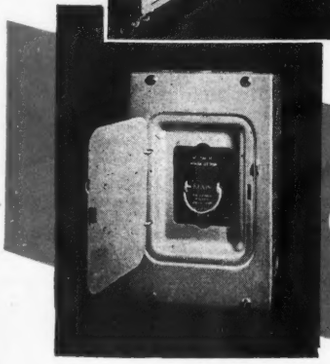




Cat. No. 81
Outdoor — Service Switch — 60 amp.







Cat. No. 72
Main or Range Switch — 60 amp.

125-250 V., 3 Poles, 2 Blades, 2 Cart. Fuses, S. N.

Compact, look swell, solderless connectors, knuckle room aplenty, ample knockouts, as easy to install as hanging a picture.

Murray SWITCHES

Get all the facts NOW!

METROPOLITAN DEVICE CORPORATION,
1250 Atlantic Ave.,
Brooklyn, N. Y.

Please send, free of charge, Murray Switch Catalog.

Name_____

Company_____

Address_____

ELECTRICAL CONTRACTING. Published monthly, price 35 cents a copy. Vol. 45, No. 5. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. Publication Office, 99-129 N. Broadway, Albany 1, N. Y. All communications about subscriptions should be addressed to J. E. Blackburn, Jr., Vice President (for Circulation Operations), Electrical Contracting, 330 West 42nd St., New York 18, N. Y. Subscription Rates—U. S. and possessions, $3.00 a year, $4.00 for two years, $5.00 for three years. Canada $4.00 a year, $6.00 for two years, $8.00 for three years. Pan American countries $6.00 for one year, $10 for two years, $12.00 for three years. All other countries $15.00 a year, $30.00 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S.

Copyright 1946 by McGraw-Hill Publishing Company.

Cable address: "McGraw-Hill, New York." Member A. B. P. Member A. B. C.

FIRST AND ONLY

EXPLOSION-PROOF FLUORESCENT

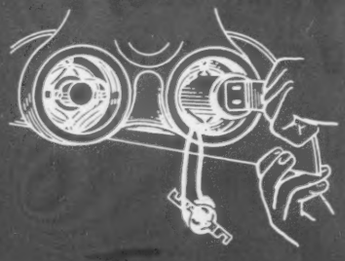
LIGHTING EQUIPMENT

Approved for all Class I, Groups C and D Class II, Groups E,F and G Hazardous Locations

UL

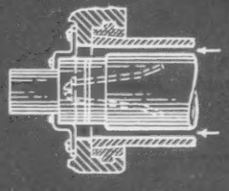
PATENTED January 1, 1946, Patent No. 2,392,392

Connecting block for line connection located conveniently inside upper explosion-proof screw cover. No other electrical connections are made on the job.



Starters just inside lower explosion-proof screw covers can be replaced without removing lamps. Re-lamping is quick and easy with help of special tool or pliers.

Ballast mounted in explosion-proof housing at center of unit, under outer dust cover, is quickly accessible. Flexible coupling relieves any possible strain on Pyrex glass tubes.



Lamps are held in position in center of Pyrex tubes by springs which also facilitate re-lamping. Column of air around lamp, inside Pyrex tubes, maintains even temperature on surface of lamp which prolongs life of lamp far beyond that of ordinary fluorescent equipment.

NOW! NEW, LARGER SIZE ADDED

Still America's *first and only* Explosion-Proof Fluorescent Lighting Fixture, this great Appleton development will be available in a new and larger size, accomodating two 60-inch, 100-watt, T-17 fluorescent lamps. The original fixture accomodates two 48-inch, 40-watt, T-12 lamps.

Note at left the important features that make Appleton Explosion-Proof Fluorescent Lighting Fixtures easy to install, economical to maintain, and safe, by a wide margin, wherever flammable gases, combustible dusts, or explosives render a location hazardous.

Thus, Appleton engineering skill enables you to bring all the advantages of modern fluorescent lighting to locations anywhere in your area listed in Class I, Groups C and D; and in Class II, Groups E, F and G. There's good business to be had by checking on those locations, now.

SEND TODAY for the big Appleton Catalog containing complete information on all of the 15,000 items in the *complete* Appleton line.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 175 Luckie Street, N.W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg. • BALTIMORE, 100 East Pleasant Street • BOSTON, 10 High Street • DENVER, 1530 Sixteenth Street • PHILADELPHIA, 1017 Cherry Street

Resident Representatives: Cincinnati, Dallas, Kansas City, Milwaukee, New Haven, New Orleans, Seattle.

APPLETON ELECTRIC PRODUCTS

A P P L E T O N

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Electrical Contracting

With which is consolidated The Electragist and Electrical Record . . . Established 1901

W. T. Stuart.....Editor
Alice McMullen .....Associate Editor
Berlon C. Cooper.....Eastern Editor
August Eckel.....Middle West Editor
W. A. Cyr.....Pacific Coast Editor
H. W. Young.....Southwest Editor
Hugh P. Scott.....Assistant Editor
Harry Phillips.....Art Editor
Stacy May...Director, Economic Staff
Donald D. Hogate
Manager, Washington Bureau

M. S. MacNaught..Manager
W. W. Garey.....Assistant Manager

DISTRICT MANAGERS

A. B. Conklin, Jr.....New York
S. A. Jones.....New York
F. J. Seiler.....Cleveland
W. B. Heaps.....Chicago

Lee H. Hill.....Publisher

McGRAW-HILL PUBLISHING COMPANY, INC. JAMES H. McGRAW, Founder and Honorary Chairman; JAMES H. McGRAW, Jr., President; CURTIS W. McGRAW, Senior Vice-President and Treasurer; HOWARD EHRLICH, Vice-President and General Business Manager; EUGENE DUFFIELD, Editorial Assistant to the President; JOSEPH A. GERARDI, Secretary; J. E. BLACKBURN, Jr., Vice-President (for Circulation Operations). Publication Office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive Offices, 330 W. 42nd St., New York 18, N. Y. *Branch Offices:* 520 North Michigan Ave., Chicago 11; 68 Post St., San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia 2; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; Atlanta 3; Los Angeles 13; Pittsburgh 22. Member A.B.C. Member A.B.P.

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management in the field of electrical construction and maintenance.

Contents for May, 1946

At a glance..... 55

Construction Control..... 57

Wiring for World Security..... 59
By HUGH P. SCOTT—How 9000 manhours of electrical work was done in 15 days to set the stage for the United Nations Conference.

NISA Meets in Tampa..... 64
A report of the convention of the National Industrial Service Association.

Helps for House Wiring..... 68
Adequate wiring promotion backs the contractor and sets the stage for the greatest residential wiring job of all time.

"T" Can Take It..... 70
By G. W. HUMPHREY and G. A. FOWLES—Rugged tests in service show qualities of polyvinyl chloride insulations under conditions encountered in chemical plants.

Rewinding and Reconnecting A-C Motors—Part I..... 72
By R. G. CAZANJIAN—The first of a series of articles on the theory of rewinding and reconnecting induction motors.

What Is the Markup?—Part II..... 74
By RAY ASHLEY—A discussion of labor overhead versus material overhead.

Training House Wiremen in St. Louis.. 77
By AUGUST ECKEL—St. Louis contractors and union have set up a twelve weeks training course in fundamentals and residential wiring techniques.

G.I. Skill Credits..... 78
The Minnesota plan sets up specific rules for crediting service acquired skills to apprenticeship and state license requirements.

Industrial Electrification..... 97
How to Select Controls—II.

Departments

Practical Methods 81
Equipment News 89
Data Sheet 102
Reader's Quiz 106
Motor Shops 117
Modern Lighting 125
Electronics 139
New Literature 147
Questions on the Code.....153
In the News.....159
Manufacturers News 171
Advertisers Index 186

Scientifically Engineered... Distinctively Designed

Pittsburgh Permaflector Presidential
FLUORESCENT LUMINAIRES
In two, three and four lamp units utilizing 40-watt, T-12 lamps. Curved Skytex glass side-panels; longitudinal baffle shield.
"The Jefferson"

Something Better has come to Light!

The Jefferson has met with unanimous approval of lighting equipment users everywhere. And with good reason . . . for *The Jefferson* and its companion luminaires in the Presidential Series are light-engineered to give lasting performance . . . are outstanding in appearance . . . and are styled in perfect taste.

The entire line of *Pittsburgh Permaflector* Fluorescent and Incandescent Lighting Equipment is simple to install . . . easy to maintain . . . and gives maximum illumination throughout its long service life. *Pittsburgh Permaflector* equipment has all these advantages—*and* is adaptable to a wide range of commercial, industrial and institutional applications.

Pittsburgh Permaflectors offer the wide-awake electrical contractor and wholesaler a prestige and highly profitable line that brings satisfaction to you and your customers. You'll be all set for more customers and bigger sales with *Pittsburgh Permaflector* Fluorescent and Incandescent Lighting Equipment.

FUNCTIONAL—
Scientifically engineered to give long and lasting performance at peak of illuminating efficiency.

DISTINCTIVE—
Outstanding in appearance . . . smart in design . . . styled in perfect taste.

FLEXIBLE—
Surface mounted . . . or pendant mounted with Hanger AH-200—individually or in continuous row.

Pittsburgh Reflector Company

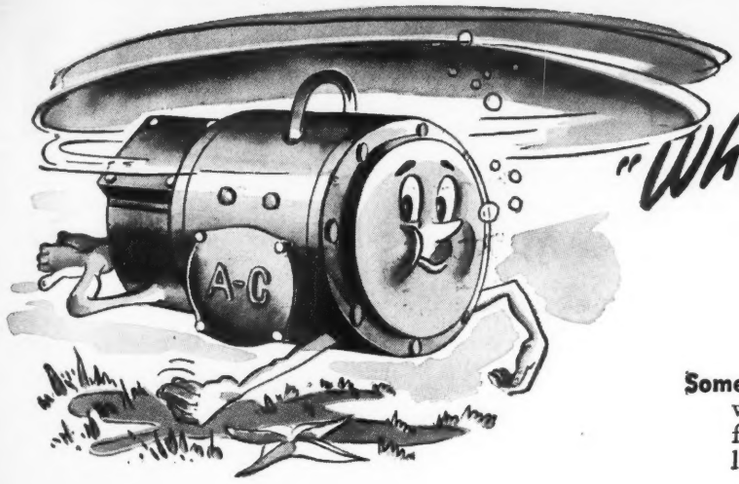
OLIVER BUILDING • PITTSBURGH 22, PA.

Manufacturers of Permaflector Lighting Equipment

DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

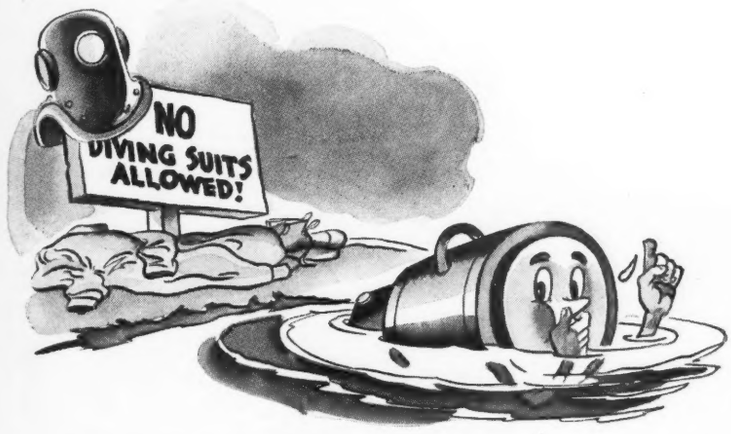
Permaflector Lighting Engineers in all Principal Cities

"Pittsburgh" Permaflector



"What! Build a Motor to Run Underwater for 90 Days?"

Some said "Impossible!" But the Navy insisted, "We want a motor that likes water so well it'll run in 25 feet of it for 90 days. What's more—it's got to be lighter, more compact than standard motors."



No diving suits allowed! Biggest problem was water-proof, pressure-proof casings. Cast-iron wouldn't do — too porous. So we turned to fabricated steel — tough, durable — and lightweight too!

Then we found that fabricated parts could be successfully welded together to assure water-tightness. For proper magnetic characteristics, we decided to use field yokes of one-inch rolled steel.

Things look better! We reinforced end-housings, double-checked insulation, made sure exposed parts were leak-proof. Nothing left to do but put our baby in the test-tank, check it regularly, and hold our breath.

90 days later—we took a good look. Motor still running and not a drop of water inside! That called for a short cheer and wide smiles all around. Mass production of these motors followed.

There's a Moral: Every time Allis-Chalmers engineering solves *special* motor problems, we discover new ways to build better standard motors for you. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 1927

Wait 'til you see the NEW

ALLIS-CHALMERS MOTORS!

Junction CONDULETS

for pulling and connecting electrical conductors — all sizes

The illustrations show a representative selection from the hundreds of different junction Condulets that are listed in Crouse-Hinds Condulet Catalog 2500. Many other housings in all sizes can be furnished with blank covers for use as junction Condulets.

(CONDULETS are made only by CROUSE-HINDS)

No. 9
of a series of advertisements which demonstrate that CROUSE-HINDS "complete line" means much more than just a range of sizes — there is a wide variety of highly specialized types in each classification.

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y., U. S. A.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington. *Resident Sales Engineers:* Albany — Atlanta — Charlotte — Indianapolis — New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

Save 22 to 38% Weight

WITH ALLIS-CHALMERS NEW DRY-TYPE TRANSFORMERS!

For every 100 lbs weight of conventional class "A" insulated dry-type transformers...
There's only 62 to 78 lbs in the new Allis-Chalmers' class "B" insulated dry-type transformer!

THIS REDUCED WEIGHT HELPS YOU TWO WAYS:

It means wider range of installation . . . you can put these handy units almost anywhere you need secondary power — even on or next to machines!

It cuts down installation cost . . . you use less mounting materials—save runs of heavy secondary copper by placing these lighter units closer to load centers.

For complete details, get in touch with your nearest Allis-Chalmers dealer or sales office, or send for new descriptive bulletin B6382.

CLASS "B" INSULATION MEANS OTHER ADVANTAGES, TOO...

Saves Space — reduces overall dimensions as much as 1/3 compared with class "A" insulated types.

Safer Installation — no combustible materials, no insulating liquids . . . thus, no fireproof vaults needed!

Longer-Life — resists higher temperature and protects against moisture.

Savings — 14 sizes ranging from 1½ to 300 kva, *cost no more* than class "A" insulated units. A 2015

HEAR THE BOSTON "POPS": *Every Saturday Evening, American Broadcasting Co.*

ALLIS AC CHALMERS DRY-TYPE TRANSFORMERS

"H·M·M! wonder what they mean by RACO?"

Don't let that question stump you. RACO is the trademark of RACO•All-Steel• Products. Any architect, builder or contractor can tell you that . . . for the approval of this complete line of switch boxes and outlet boxes is nation-wide.

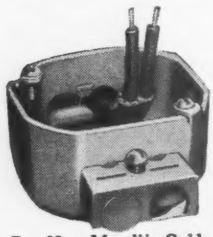
WHAT THE RACO • ALL-STEEL • LINE MEANS TO YOU

Raco means a *clean* line. No dirt, grease . . . no jagged edges. Always a smooth, glossy finish.

Raco means a *packaged* line. Every Raco • All-Steel product, no matter the size or quantity, comes to you in an attractive carton. A carton that has readable index of product number, quantity and finish.

Raco means a *uniform* line. Raco products are all made to the same exacting standards found in other precision products that All-Steel has been making for over 33 years.

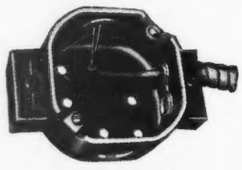
Raco•All-Steel•Line is *sold nationally* through wholesalers only. It's the quality line of dependable products. Look for the Raco trademark . . . the sign of better workmanship.



For Non-Metallic Cable

THE JAY-KAY (J-K) BOX

Made for "BX" but with bushing plate removed, it becomes a box for non-metallic cable. Supplied in 3¼" and 4" diameters. Boxes only or assembled on bars; outside clamps allow more wiring room. Use this box now when connectors are scarce.



For BX Cable

ALL-STEEL-EQUIP COMPANY, INC.
600 Kensington Avenue, Aurora, Illinois

RACO • ALL-STEEL • PRODUCTS
SWITCH BOXES • OUTLET BOXES

GENERAL ELECTRIC

Announces . . .

NEW

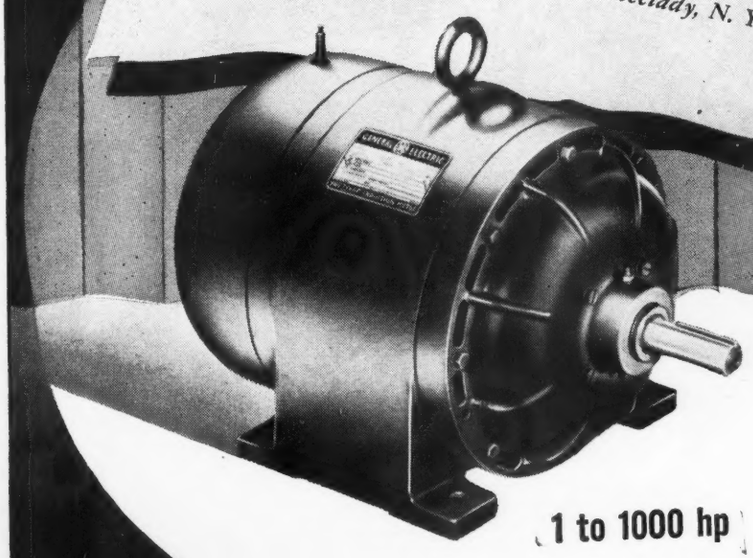
Totally Enclosed TRI-CLAD MOTORS

In 1940, G.E. introduced the Tri-Clad open motor—with emphasis on the feature that industry wanted most in a motor, *protection*. Since then, more Tri-Clads have gone into service than any other integral-horsepower motor.

Today, we are ready with a new line of Tri-Clad motors—*totally enclosed, fan-cooled motors*—built on Tri-Clad design principles in both standard and explosion-proof types.

We believe that these are industry's most dependable motors. They are designed specifically for use in many adverse atmospheres—in iron dust, outdoors, in hazardous areas, and chemical atmospheres. Their scope of application is as wide as the field of industrial motor use. Safe-guarded against most sources of motor damage, their longer life and lower maintenance will make them economical motors for use on almost every job. *General Electric Company, Schenectady, N. Y.*

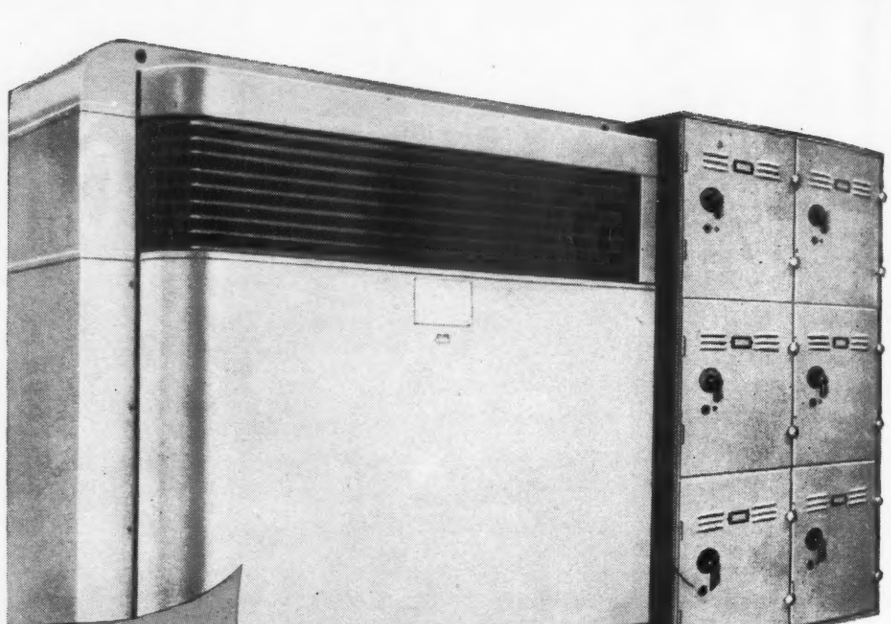
750-260-8030



1 to 1000 hp

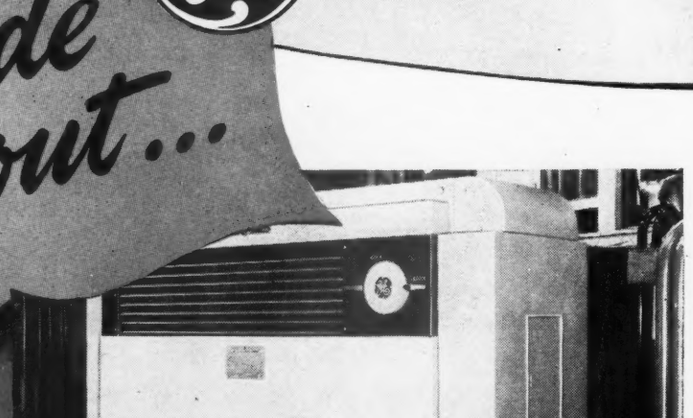
COMPLETE ENCLOSURE FOR PROTECTION AGAINST DIRT, DUST, AND WEATHER

A typical G-E dry-type substation, made up entirely of standard elements and equipped with metal-enclosed, drawout air circuit breakers. Units like this can be added one-by-one until your entire plant is converted to a co-ordinated load-center system.



SOUND DESIGN *inside and out...*

DRY-TYPE



A "bright spot" anywhere in the plant, this G-E dry-type load-center unit substation (150 kva) is completely self-contained, incorporating high-voltage potheads, disconnecting switch, fuses and low-voltage thermal breakers.

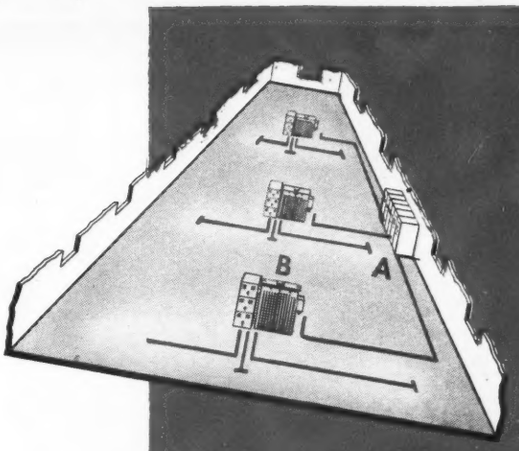
G-E dry-type unit substations are styled to meet 1946 requirements for neatness and clean-cut appearance in your plant equipment-layout. Their design simplicity lends itself to ease of location and facility of installation. Their light weight reduces structural problems.

Users who prefer dry-type equipment will find these unit substations at the top of their class in their ability to handle overloads. For, the transformer sections of G-E dry-type unit substations are designed to meet AIEE Standards No. 1 for Class B insulation, with *130 C maximum hot spot temperature* in a maximum ambient of 40 C. They also meet ASA Standards C-57.1, which limit the observable temperature rise to 80 C.

These unit substations have factory-matched switchgear —that is, the interrupting capacity of the switchgear section is matched, electrically, mechanically, and thermally, with transformer characteristics.

G-E dry-type unit substations are repetitively manufactured. This is a feature adding to their flexibility, for as load requirements change, expansion is met by the addition of similarly matched units, block by block. Thus, a planned efficient load-center power distribution system is always in operation in your plant. G-E dry-type unit substations are available in ratings up to 2000 kva, 15,000 volts.

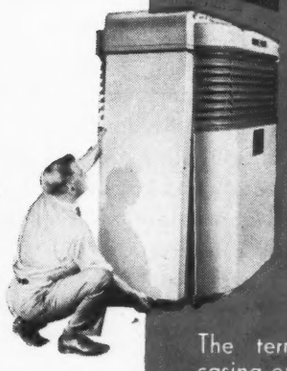
Ask for bulletins GEA-3592A and GEA-3714B. Call your nearest G-E representative or write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



In a modern load-center distribution system, power is distributed from metal-clad switchgear (A) at relatively high voltage (2.4 to 13.2 kv) to load-center unit substations (B) located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through short secondary feeders.

UNIT SUBSTATIONS

G-E dry-type unit substations have been supplied in quantity since early in the war-construction period, and sizes and types to meet individual load conditions can now be ordered "right out of the catalog."

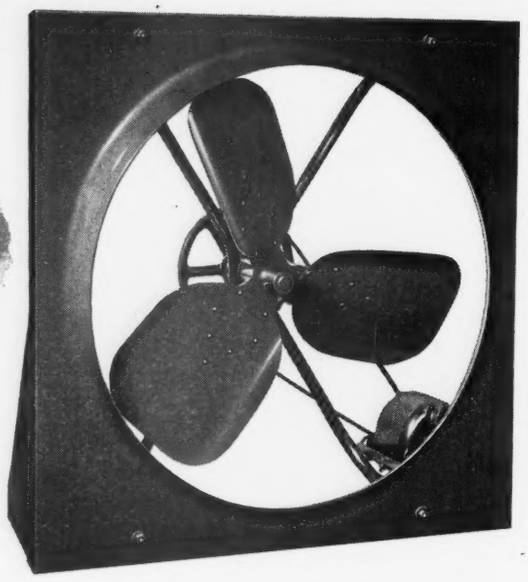


The terminal compartment casing extends down the entire side of the substation, facilitating cable entrance connections. The unit can be moved into place after conduit and cable have been made up. On vital conversion jobs, this convenience feature will save many precious hours.

GENERAL ELECTRIC

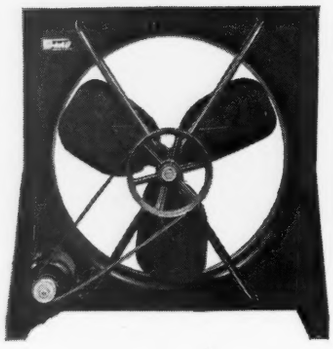
321-44-5900

Make Way for Morpheus!



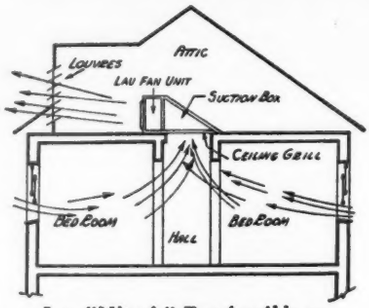
Selling Summer Comfort is a Cinch with

LAU "NITEAIR" CIRCULATING FANS



...designed for a wide variety of practical applications ...to provide Sleeping Comfort in Homes, Shopping Comfort in Stores, Working Comfort in Offices and Factories.

When old Sol has made a "hot box" of every structure in the town . . . when a man would give 'most anything for relief from soaring temperatures and high humidity . . . there's a ready market for Lau "Niteair" Attic Exhaust Fans and a ready PROFIT for the dealer or contractor selling them. Summer affords most receptive market, but sales made in any season wherever it is desirable to control air, keep room temperatures constant, circulate fresh air in confined enclosures, remove dust, smoke, fumes, and so on. Mass manufactured on assembly line methods in the new Lau Fan plant (all parts except motors and belts made by Lau) at extremely low cost for competitive selling—with splendid profit opportunity for Lau dealers and contractors.



Lau "Niteair" Fan forcibly exhausts hot, stuffy air . . . circulates cool, refreshing night air through every room. Equally adaptable to any size, type of construction, or room arrangement of house.

Write direct or contact your jobber for full information, specifications, prices.

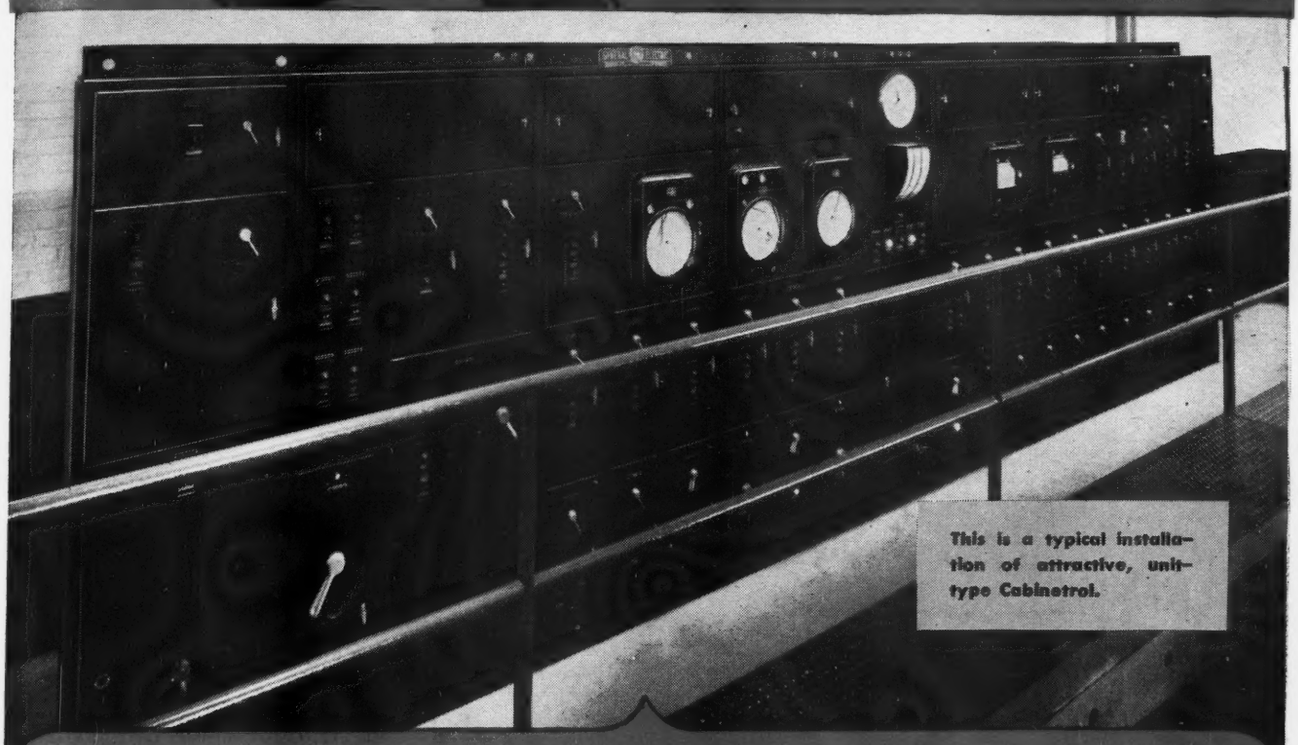
THE **LAU** BLOWER COMPANY

DAYTON 7, OHIO, U. S. A.

WORLD'S LARGEST MANUFACTURER OF FURNACE BLOWERS

Engineers and fabricators of general Air Handling Equipment • Single Inlet and Double Inlet Blowers • Propeller Fans • Accessories

HODGE-PODGE CONTROL IS EXPENSIVE!



This is a typical installation of attractive, unit-type Cabinetrol.

Trim, Modern CABINETROL Cuts Installation Time and Cost

Rambling, space-taking racks are a thing of the past. Control in the *modern* plant is compact, centralized G-E Cabinetrol. It's attractive in design, safe to operate, and it costs no more!

Cabinetrol saves installation time and expense because it's a single, self-supporting unit. No cumbersome frames—no cluttered walls. Just one attractive, all-metal unit that will greatly enhance the appearance of your mill.

The savings in installation cost that you get with Cabinetrol usually far outweigh its higher original cost. Only two operations are necessary—placing the unit in the designated location and connecting external power, motor, and control leads.

IT'S PRE-ENGINEERED

Cabinetrol is based on the use of standard enclosures equipped with the right combination of standard control devices. Each unit is pre-engineered to meet your specific requirements. All starters and accessory equipment necessary to your application are incorporated in the Cabinetrol unit before it is shipped.

PROTECTS YOUR OPERATORS

Because metal-enclosed Cabinetrol is completely deadfront, it offers your operators and servicemen maximum protection. Each motor control is installed in an individual sheet-steel compartment with an interlocking door. Operating mechanisms for motor-circuit switches and air circuit-breakers are available from the front of the panel.

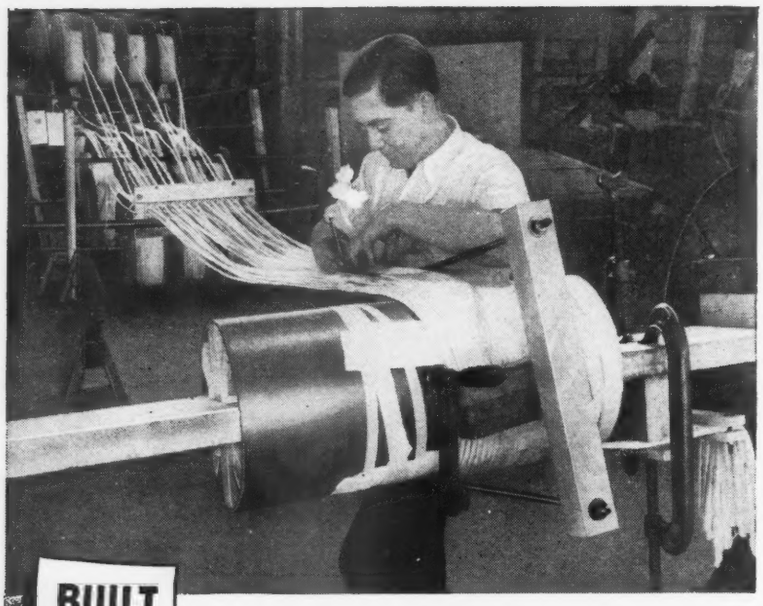
LET US HELP YOU equip your plant with co-ordinated control. We'll be glad to work with you now—to provide a Cabinetrol system specially engineered for your plant—and, if you desire, to help you fit Cabinetrol into your over-all plans.

If you'd like more facts about Cabinetrol ask for Bulletin GEA-3856. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E INDUSTRIAL CONTROL

GENERAL ELECTRIC

AMERTRAN QUALITY



is maintained by

CARE

. . . in hundreds of details

BUILT WITH CARE *. . this high current winding is typical*

AMERTRAN ADVANTAGES:

- High turn-to-turn insulation
- Linear surge-voltage characteristics
- Fully balanced coil design
- Coils vacuum impregnated
- Rigid core construction
- Optimum impedance
- "Tailored" tanks
- Electrically brazed connections
- Rust resistant external parts

A SPECIAL AmerTran procedure is used to position multi-conductor windings. In this case 39 conductors (totalling ½" thick by 4⅞" wide) are wound at one time, fed through non-chafing guides. Multiple strands increase flexibility, prevent permanent distortion from surges, and reduce eddy losses in the coils. Transpositions further neutralize disturbing currents.

Rigid blocking and neat taping contribute to a firm, symmetrical winding of uniform stress and high electrical efficiency.

Equal care in all other AmerTran manufacturing operations has helped maintain AmerTran leadership in transformer practice—for 45 years.

AMERTRAN

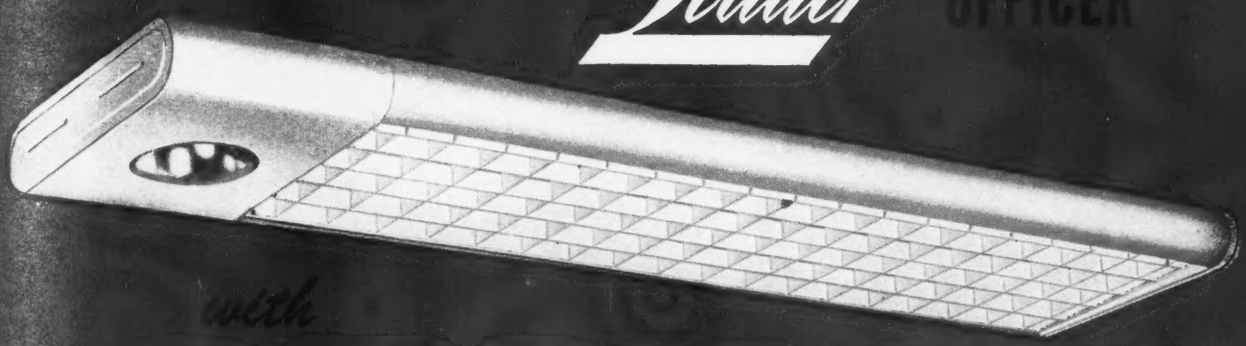
REG. U. S. PAT. OFF.

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERICAN TRANSFORMER COMPANY
178 Emmet Street • Newark 5, New Jersey

THE *Leader* OFFICER



with

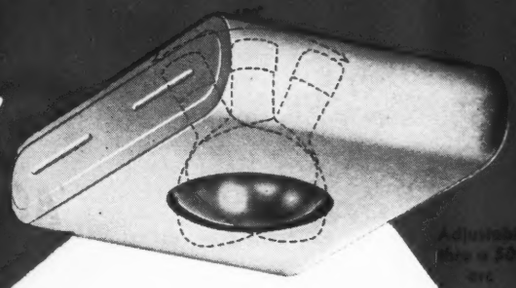
"DIRECLITE"

The most Outstanding Commercial Fixture

Plus . . . . MERCHANDISE

"Spot"

LIGHTING



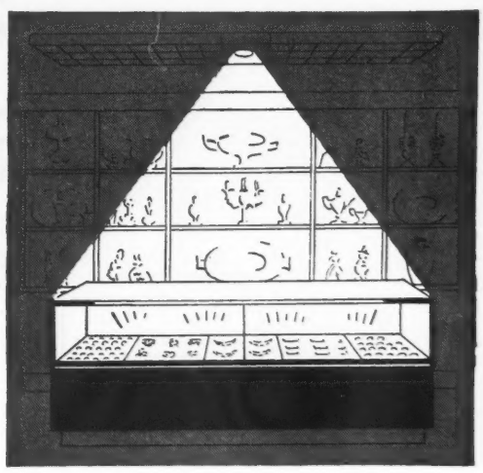
Leader Engineers now present the Direc[lite] for spot lighting of merchandise. Direc[lite] is easily attached at the end of a single unit or the center of a continuous run installation where any Leader Officer is used.

Thousands of installations have already proved the superiority of the Leader Officer Unit. Here is a fixture combining utility and high light output with beauty of design.

Now the Officer Unit is available for additional merchandising uses, thus giving it extra merit to the high position it already enjoys.

Representatives in all principal cities.

Distributed only through the Better Electrical Wholesalers

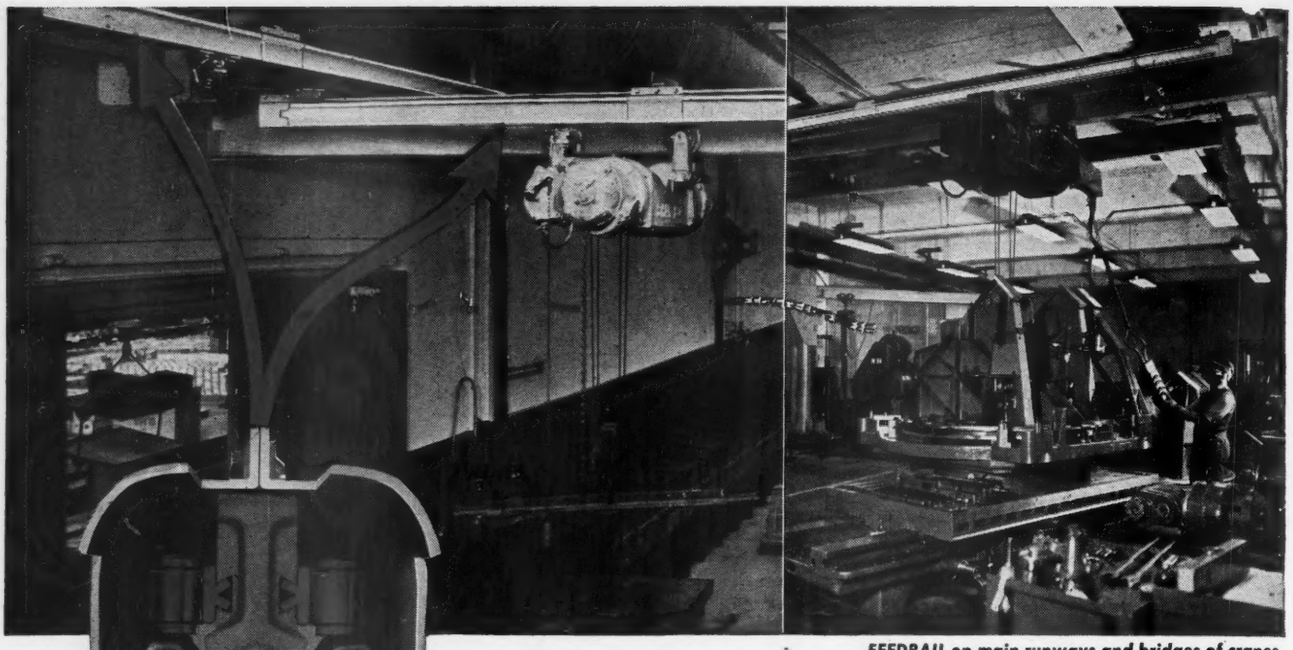


THERE IS A LEADER REPRESENTATIVE IN YOUR AREA

Leader ELECTRIC MANUFACTURING CORP.

6127 NORTH BROADWAY • CHICAGO 40, ILLINOIS

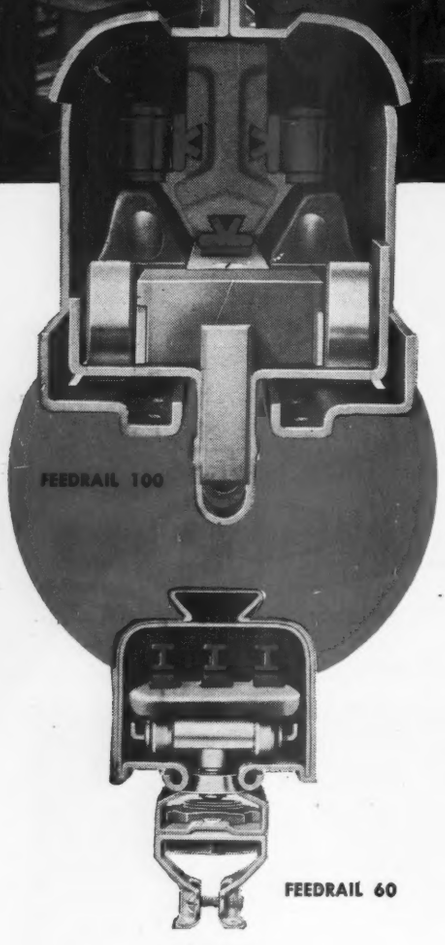
WEST COAST FACTORY • 2040 LIVINGSTON STREET, OAKLAND 6, CALIF.



FEEDRAIL on main runways and bridges of cranes

MODERNIZE

YOUR CRANES AND HOISTS WITH FEEDRAIL



Exposed trolley wires have no place in a modern plant. In a day's time, you can substitute the enclosed ELECTRIC FEEDRAIL System.

It requires little space, and is furnished in assembled units in stock lengths and curves. Also available for transfers and switches to fit any desired layout.

Feedrail is mechanically strong, electrically foolproof. Trolleys are completely polarized. All electrical parts enclosed, protected against dust — accidental shorts — mechanical injuries.

Ask for

ELECTRIC FEEDRAIL
CATALOGS GENERAL No. 15
NEEDLE TRADES No. 16
MACHINE TOOL No. 17

AND HIGH CYCLE TOOLS

Feedrail is also designed especially for high cycle and portable tools and is used extensively for moving test racks.

ELECTRIC FEEDRAIL

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company

125 BARCLAY STREET • NEW YORK 7, N. Y.

CORDS—

that pay their own way

NOW YOU CAN HAVE THEM . . . lightweight, flexible cords that are practically non-aging. They're protected with VINYLITE plastic insulation and establish new highs in safety, service life, and long-run economy. Drag and yank these cords over concrete floors—around machines and equipment. Their modern insulation stands the gaff, for it's remarkably tough and abrasion-resistant. Smear them with water, oils, grease, or most common solvents—expose them to alkalies and sunlight—the insulation retains its high dielectric strength. Further, VINYLITE plastics are inherently slow-burning, and non-flammable types are available when desired.

Unsurpassed on cords for portable tools and household appliances, VINYLITE plastic insulation is bringing new ease of installation, new reliability and safety to wires and cables in the public utility, communications, industrial, and construction fields, and for marine, radio, and aircraft applications. Its thin-wall construction permits more wires in existing conduits. It can be made in many colors.

Write Department 41 for Booklet W-4, "VINYLITE Plastics for Wire and Cable Insulation." And call on Bakelite engineers at any time for help in applying VINYLITE plastic insulation, technically and economically, to your own requirements.

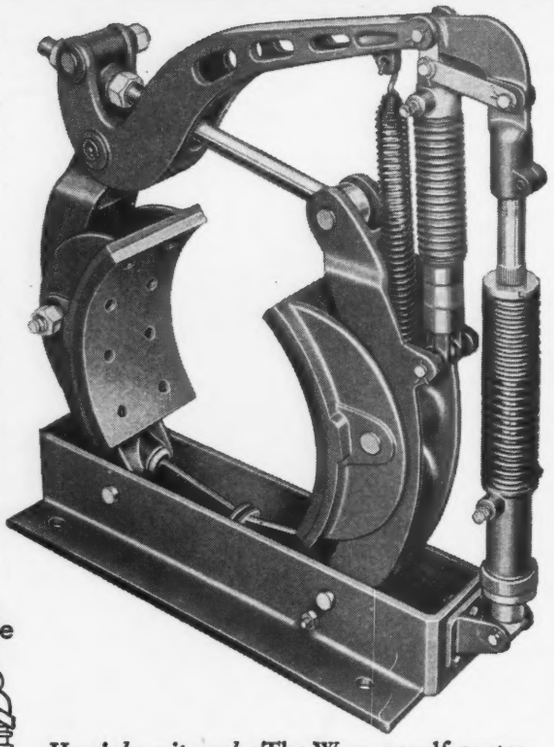
VINYLITE
TRADE-MARK
PLASTICS

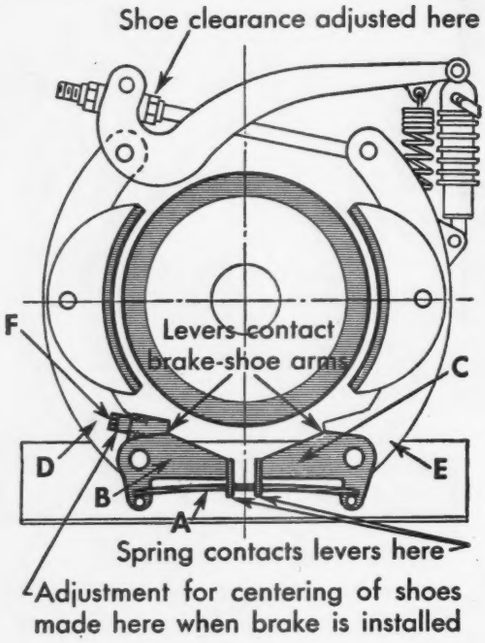
BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 EAST 42ND STREET, NEW YORK 17, NEW YORK

Wagner Self-Centering Device PREVENTS BRAKE-SHOE DRAG

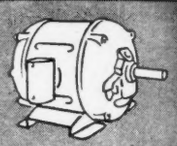
The new self-centering device on Wagner hydraulic bridge brakes prevents brake-shoe drag—thereby eliminating unequal brake-shoe wear and undue heating of the brake wheel.

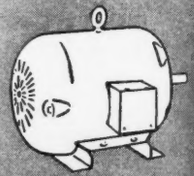
It is simple in operation and requires no readjustments after installation. With the Wagner self-centering device, brake shoes remain centered irrespective of lining wear. It prolongs the life of the brake lining and reduces maintenance expense. Write for complete information. Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.

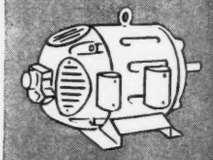


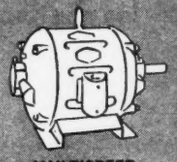


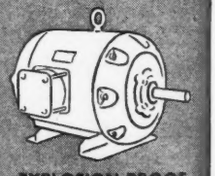
Here's how it works: The Wagner self-centering device utilizes the principle of the swinging door—in which a spring returns the door to the same starting point irrespective of direction of swing. A leaf-type spring (A) in the base of the brake actuates the ends of two levers (B and C) which bear equally against the two brake-shoe arms (D and E). The spring assures equal movement of both shoe cams, thus preventing either brake shoe from remaining in contact with the brake wheel. Brake shoes are originally centered at point (F) by means of a setscrew which is locked after the shoes have been accurately centered—after which the self-centering device keeps the shoes centered and prevents brake-shoe drag until relining is necessary, at which time recentering by means of the setscrew may be necessary.

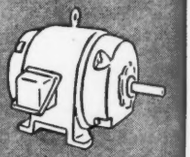

SQUIRREL-CASE MOTORS

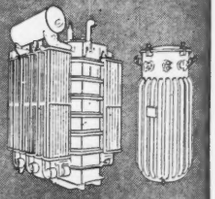

TOTALLY-ENCLOSED FAN-COOLED MOTORS

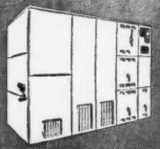

WOUND-ROTOR MOTORS


MULTISPEED MOTORS


EXPLOSION-PROOF MOTORS


SPLASH-PROOF MOTORS


POWER AND DISTRIBUTION TRANSFORMERS


UNIT SUBSTATIONS

Other WAGNER PRODUCTS for Industry: • AIR BRAKES • BRAKE LINING • ELECTRIC MOTORS • HYDRAULIC BRAKES • INDUSTRIAL BRAKES • INDUSTRIAL BRAKE CONTROLS • NoRoL • TACHOGRAPH • TRANSFORMERS

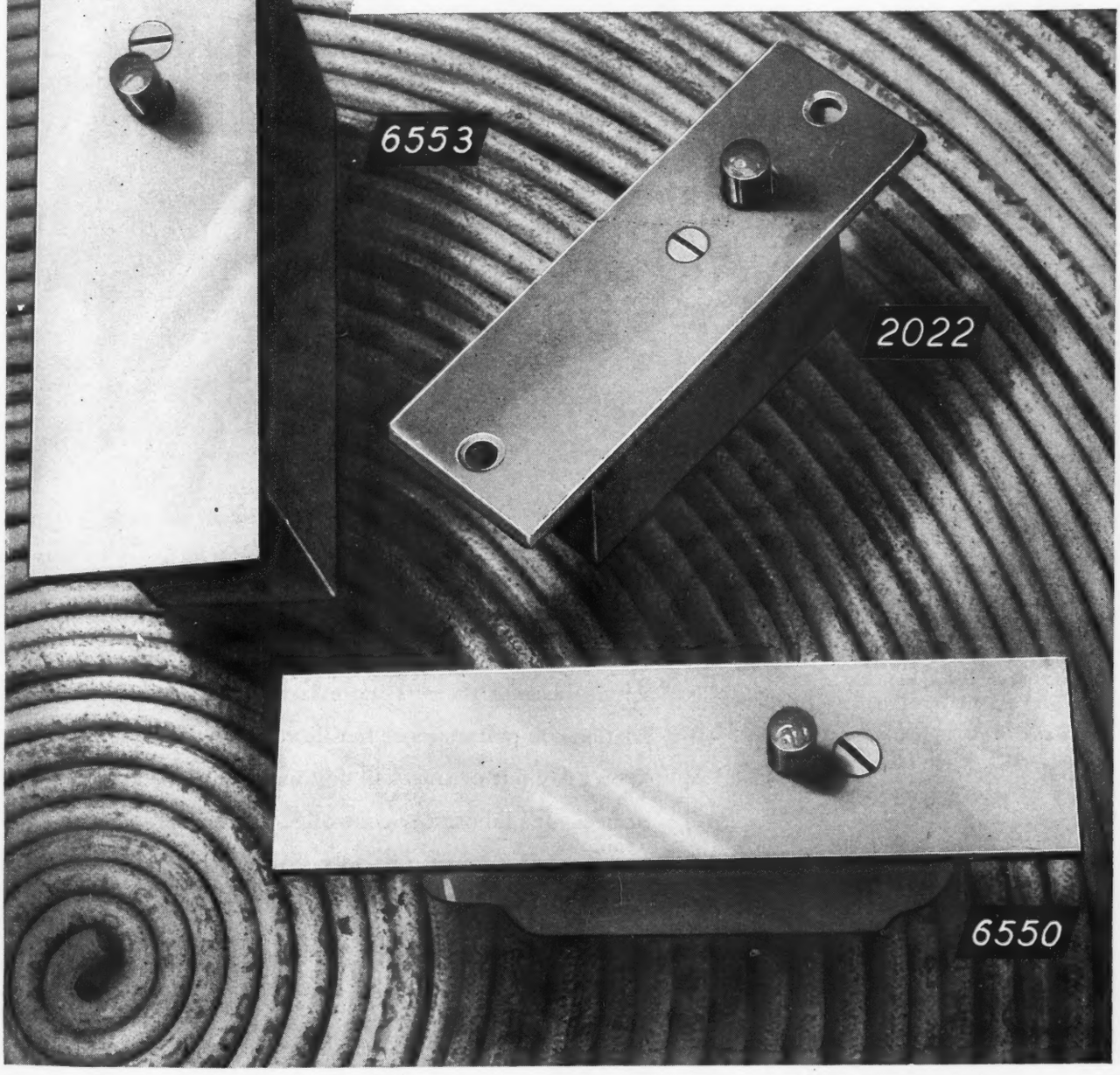
Consult Wagner Engineers on all Industrial Braking Problems

Wagner WE I46-1

Sales and Service Branches: ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 CINCINNATI 10 • CLEVELAND 15 • DALLAS 1 • DENVER 2 • DETROIT 2 • HOUSTON 2 • INDIANAPOLIS 4 KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3 • MILWAUKEE 2 • MINNEAPOLIS 4 • NEW YORK 7 OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9 • ST. LOUIS 3 • SALT LAKE CITY 1 SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5
In Canada: WAGNER ELECTRIC AT LEASIDE, ONTARIO

H & H DOOR SWITCHES

Automatically control the lights by opening and closing of doors as in closets, storage and refrigeration chambers, vaults etc. Numbers illustrated here are designed to switch on lights when door is opened; others available for lighting when door is closed. No. 6553 comes complete in an approved box with 23/32" and 1/2" knockouts and clamp for flexible metallic conduit. No. 2022 is mounted in a steel box, porcelain lined. No. 6550 is mounted in a porcelain base; fits all standard door switch boxes. Ratings: 6 Amps., 125 V.; 3 Amps., 250 V. Striker plates come with each switch. Ask for *complete* line listings.



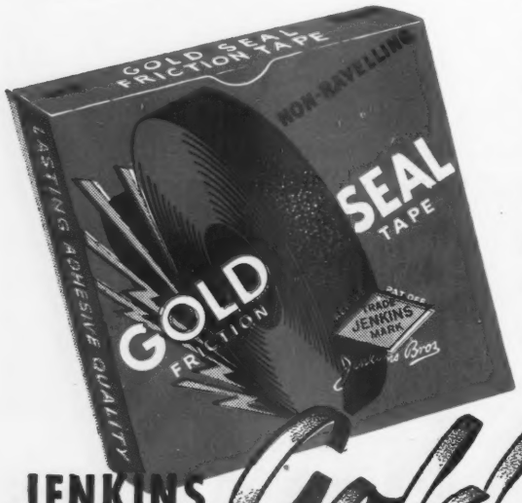
DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

HART & HEGEMAN DIVISION

ADEQUATE WIRING SERVES AND SAVES

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

Other Jenkins Bros. tape products include Diamond Seal Friction and Rubber Tapes, which meet ASTM and Federal specifications.



Gold Seal Tape has a grip like a gorilla – and then some – because there is more lasting tackiness in the friction compound, more tensile strength in the fabric. Won't dry out or smear in any weather, – won't ravel or peel. It's laboratory-controlled all the way . . . and it comes all the way to you factory-fresh in its cellophane wrapper. Next time you order tape, specify Gold Seal! Jenkins Bros., Rubber Div., 80 White St., New York 13, N. Y.

JENKINS

Jenkins Bros.

Gold Seal Tape

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

THERE'S MONEY IN FARMING

for you-with millions of new REA wiring jobs...

A few of the complete Killark Line of rural electrification fittings are shown here:

Moistureproof and watertight lights
Yard lights
Entrance fittings
Ground Clamps
Cable heads
Weathertight outdoor receptacles

The modern farm is an "industrial plant" that needs a lot of wiring and fittings to handle the many daily jobs that need electrical power. Cream separators—milking machines—butter churns—saws—paint sprays—waterpumps—washers—refrigeration—lighting—fans . . . are only some of the farm needs for many types of outlets and fittings needed to put REA power to work. The Killark Line is the complete line of rural electrification fittings that meet farming requirements—and they meet every requirement of the contractor for an efficient, safe and profitable job.

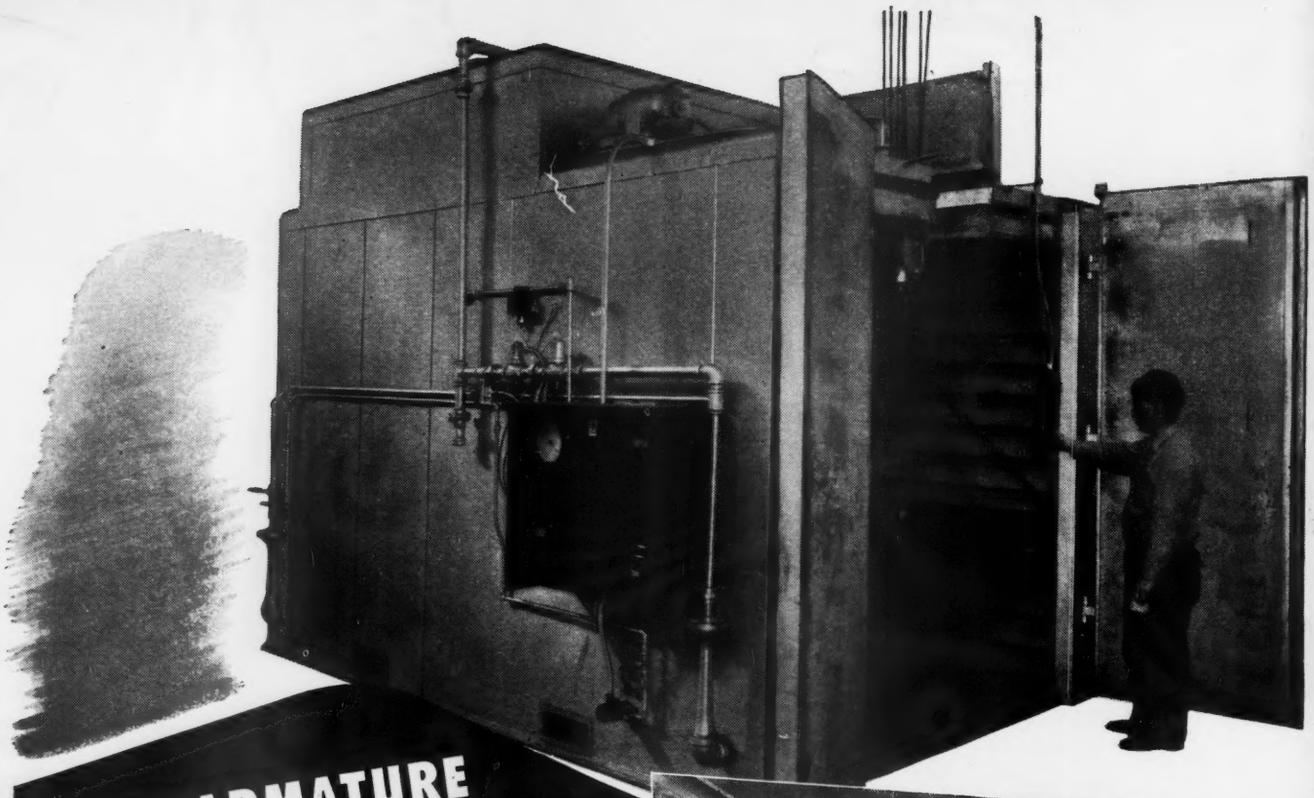
Write for Killark's illustrated informational bulletin on Rural Electrification Fittings.

KILLARK ST. LOUIS

Killark

Offices and Warehouses: Atlanta, Baltimore, Boston, Chicago, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle and Syracuse.
Offices: Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Minneapolis.

Vandeventer & Easton Ave.
SAINT LOUIS 13, MO.



BAKE ARMATURE and TRANSFORMER COILS IN AN OVEN BUILT *for that purpose*

The baking of coil insulation is an important operation in servicing electrical equipment and, therefore, an oven properly built for that purpose is one of the most important pieces of equipment in the service shop. Such an oven should have these characteristics:

1) Operate on any predetermined baking cycle.

2) Maintain close time-temperature relationship at all times.

3) Repeat accurately any specified cycle.

4) Prevent objectionable fumes from contaminating the air in the shop.

5) Prevent formation of explosive gas mixtures in the oven.

6) Operate without raising the temperature of the air in its immediate vicinity.

A Young Brothers oven meets all these specifications and in addition will bake your coil insulation to maximum toughness in the shortest time with the least supervision, and at the least expenditure for fuel or energy.

Ask for information on what these units have done in other service shops.

MEMBER

INDUSTRIAL OVENS FOR ALL PURPOSES UP TO 1000°F

YOUNG BROTHERS COMPANY

6526 MACK AVENUE DETROIT 7, MICHIGAN

ESTABLISHED IN 1896

TOUGH JOBS LIKE THIS

are PLAY for DREADNAUGHT WELDING MACHINE CABLE

Paranite Dreadnaught Welding Machine Cable is just one, but an outstanding member, of the Dreadnaught family. The tough, polished rubber jacket over the skeleton braid, the insulation and the cotton separator, provides a housing built to stand the abuse inherent in portable and stationary welding machine operation. The multiplicity of fine rope-lay annealed copper strands combines to make a tough, flexible, trouble-free conductor from the welding machine to the electrodes.

Paranite Dreadnaught Power Cable brings the power to the welding machine, or for that matter to any heavy duty portable machine—Dredges, Mining Machines, Shovels, Cranes, etc. Dreadnaught Cable is available in single or multiple conductors.

{Distributed through wholesalers.}

FLEXIBLE

Conductors are multiples of fine strands—for extra flexibility, freedom from kinking and insures high conductivity.

SAFE

Insulation is of the finest quality—for high dielectric strength, high physical strength, low leakage.

DURABLE

Jacket is vulcanized in lead, abrasion-resistant; flexible, too, yet exceptionally strong and durable.

IF IT'S
PARANITE
IT'S RIGHT!

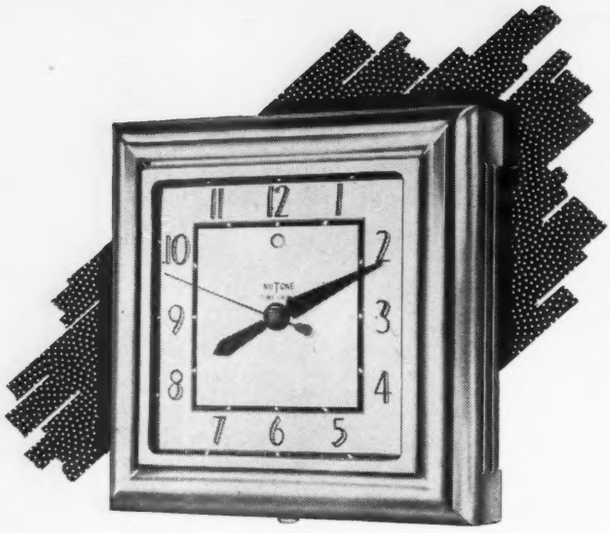
PARANITE WIRE AND CABLE

Division of ESSEX WIRE CORPORATION

GENERAL SALES OFFICES: FORT WAYNE 6, INDIANA
MANUFACTURING PLANTS: MARION, INDIANA • JONESBORO, INDIANA

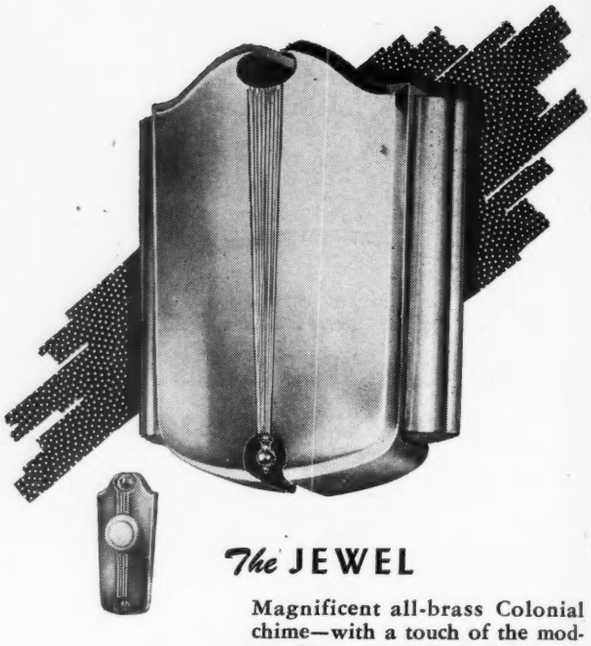
WAREHOUSES* AND SALES OFFICES: *Atlanta, Ga.; *Chicago, Ill.; Cleveland, Ohio; Dallas, Texas; *Detroit, Mich.; *Kansas City, Mo.; *Los Angeles, Calif.; *Newark, N. J.; Philadelphia, Pa.; San Francisco, Calif.; *St. Louis, Mo.; Washington, D. C.

ELECTRICAL WIRES AND CABLES *"BETTER THAN CODE REQUIRES"*



The TIME-CHIME

Combination *Telechron* electric kitchen clock and 2-door NuTone Chime. 9-inch-square, all-chrome cover. List (approx.) $12.95.



The JEWEL

Magnificent all-brass Colonial chime—with a touch of the modern. Two tones, front door—one tone, rear. 7 inches wide, 9 inches high. With matching push button, (approx.) $8.95, list.

It pays to specify the door chimes most people want

The SYMPHONIC

New! The *only* compact (14¾ inches high) *eight-tone* Westminster door chime! Unequalled in beauty and tone . . . never before approached in price, in beautiful gift carton (approx.) $24.95, list.

Easier to recommend. You never need "sell" NuTone Chimes to your clients. They are *preferred*—a preference that has made NuTone the world's largest maker of door chimes.

A complete line. NuTone offers a wide range of models to suit every need and purse. From compact kitchen chimes listing at $3.50 to luxuriant hall-clock door-chime combinations at $49.95.

Easier to work with. You can choose from a variety of styles that match any type of interior construction and finish—from sleek ultra-modern to classic period designs.

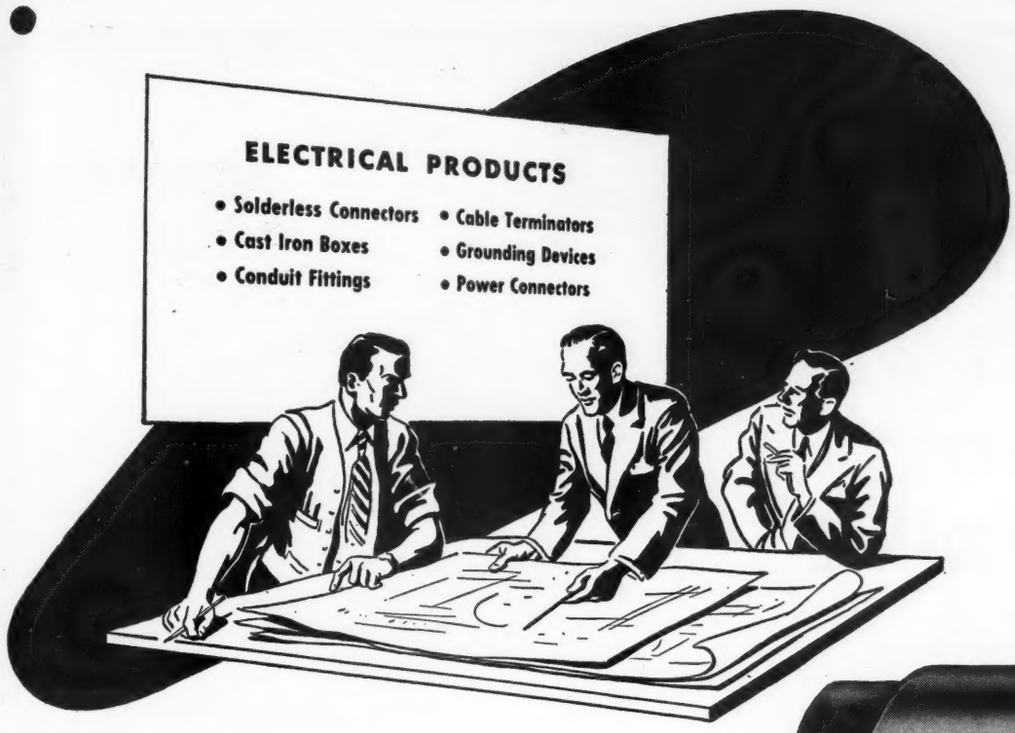
More dependable. You avoid embarrassing failures. NuTone Chimes are precision built . . . with dust-protected, lifetime working parts and durable plastic, brass, and steel exteriors.

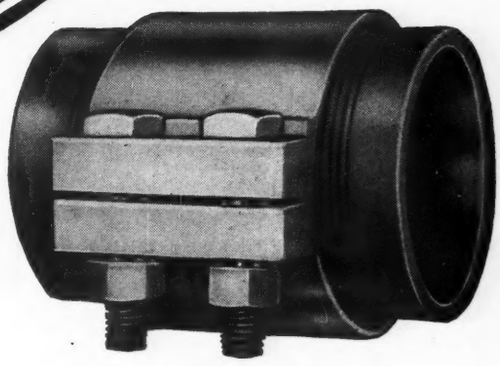
Easy to install. Even easier if you provide for chime wiring during construction. A *removable* power unit on most NuTone models makes servicing a cinch.

• For details on the door chimes that offer you the most advantages—that are the kind most people want—address your nearest NuTone office. *NuTone, Incorporated, Merchandise Mart, Chicago 54; 200 Fifth Ave., New York 10; 931 East 31st St., Los Angeles 11; or Terminal Sales Bldg., Seattle.*

WORLD'S LARGEST MAKER OF DOOR CHIMES

NUTONE TRADE MARK





SPLIT COUPLINGS . . .
CONTRACTORS SAY THEY'RE O.K.

if they're O.Z.

CONTRACTORS reduce today's building costs TWO ways by specifying Split Couplings by O.Z.

ONE INITIAL PURCHASING COSTS ARE KEPT TO A MINIMUM. The simple one-piece malleable iron construction insures a low priced, high quality product.

TWO INSTALLATION COSTS ARE REDUCED. The Split Coupling is normally spread open so that it easily slips over the ends of the conduits to be joined. Then by merely tightening the nuts, the butted ends of the conduits are fastened together. Note particularly that the only operation required is turning the nuts—the heads of the screws are restrained from moving by the shoulder on the outside of the Coupling.

O.Z. ELECTRICAL MANUFACTURING COMPANY
262 BOND STREET · BROOKLYN, 2 N. Y.

280

For details on these and other electrical products in the complete O.Z. line, get in touch with your local O.Z. distributor. He's set up NOW to serve your requirements from stock.

WHEN YOU INSTALL DELTABESTON* WIRE AND CABLE

Wiring in boiler rooms, foundries, laundries, and other hot locations can be a trouble-source to the contractor who is not *temperature-conscious* about his choice of wire.

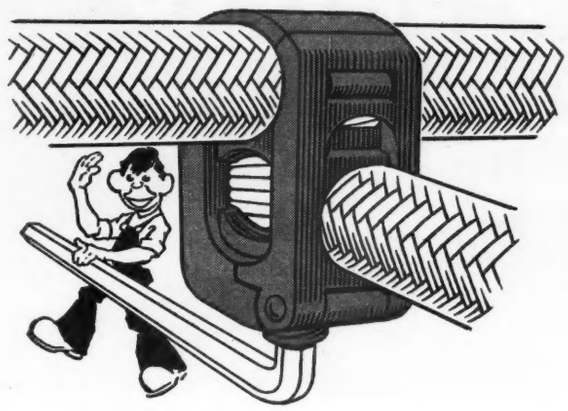
By recommending and installing DELTABESTON, you can be confident of wiring with heat resistance that *holds up.* Outages, fires, and early replacement won't threaten the job.

DELTABESTON boiler-room wires are insulated with an impregnated wall of felted asbestos and an abrasion-resistant asbestos braid. Exposed or in conduit, they resist heat, moisture, oil, grease, and corrosive vapors. A full line of DELTABESTON power cable of the same basic heat-resisting construction permits a uniformly well-protected job.

You can obtain additional information by writing to Section Y-563-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn. All Deltabeston asbestos-, glass-, and synthetic wires are distributed by G-E Merchandise Distributors.

*Trade-mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC

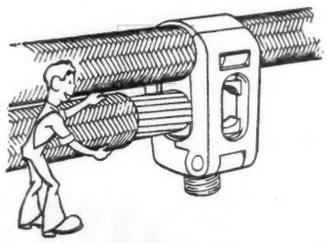


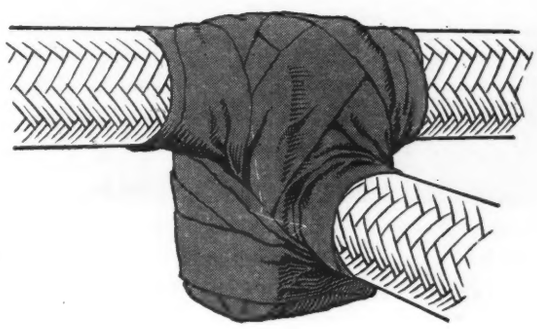
EASY TO TAP

SURE THING

This T&B Pressure (Solderless) Lock-Tite* Connector is quickly tightened with a key wrench. Holds fast with encircling pressures that defy man-made vibrations. One piece construction. Slips over cables neatly. Streamlined for easy taping.**

Hangs by itself on main cable, making it easy to install branch in either tee or parallel position.





EASY TO TAPE

The sureness **of this T&B Tee Parallel Tap and other Lock-Tite Connectors is confirmed by Approvals from the Underwriters Laboratories.**

Made in all sizes for tapping mains 1/0 to 1,000,000 CM to all branches #2 to 1,000,000 CM in all possible combinations. Lock-Tite Connectors are economical to stock since each fitting takes several overlapping sizes of any kind of cable. 100% salvageable. Distributed solely through the service organizations of T&B Electrical Supply Wholesalers.

Another sure thing: **They are available now.**

*Trademark **Patented

T&B ENGINEERED

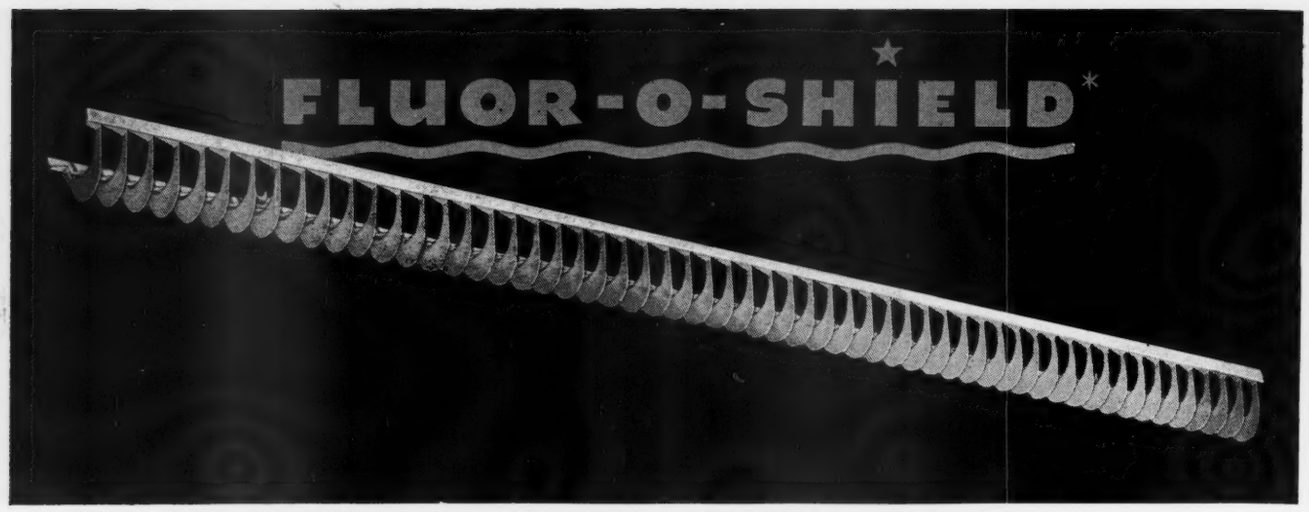
The Thomas & Betts Co.

INCORPORATED

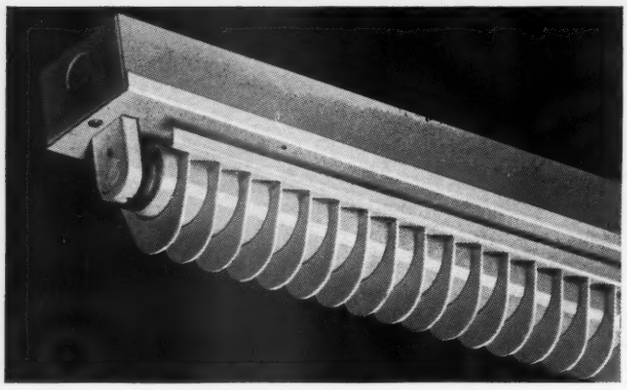
MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1898

ELIZABETH 1, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal



Fluor-O-Shield is made of durable lightweight aluminum, finished in white baked enamel.



No glare—greater efficiency. Casts no shadows.

Instantly attached without bolts, screws or tools.

FLUOR-O-SHIELD*

light diffuser for fluorescent lamps

- Snap-on clips permit instant attachment or removal.
- Fits open-face fluorescent lamp fixtures.
- Eliminates glare, minimizes stroboscopic effect, reduces eyestrain.
- Readily adaptable for office, factory, store, school and home fluorescent lighting.

*Trade Mark—Patent Pending

SPECIFICATIONS

Catalog Number	Length	Fits Lamp	Units per Pkg.
27-1-40	46⅞ in.	40 watt	12
27-5-40	22⅞ in.	20 watt	12

Couple the advantages of fluorescent lighting with the practical utility of Fluor-O-Shield—the simple one-piece louver that diffuses light evenly, prevents glare, reduces eyestrain. More efficient work, more sales, and improved lighting for store displays, production lines and office layouts are immediately possible with inexpensive Fluor-O-Shields. No trick to change burned-out lamps—Fluor-O-Shields simply snap on and off. Lightweight—cause no stress or strain on lamps or sockets. Equally suitable for continuous or unit mounting.

$ALES-WISE DEALERS: Step into a quick, profitable business selling Fluor-O-Shields as a multiple item with fluorescent lamps and starter replacements. Fluor-O-Shields are easy to stock, nest to take little space and move out rapidly. Remember — practically every user of fluorescent lighting is a prospective Fluor-O-Shield customer.

$1.95 40 watt 46⅞ inch Retail list price

$1.25 20 watt 22⅞ inch Retail list price

Available in two sizes for 40 and 20 watt lamps. Prompt delivery. If your distributor does not have Fluor-O-Shields, ask him to write:

FLUOR-O-SHIELD*

CAMFIELD MANUFACTURING COMPANY
Grand Haven, Michigan

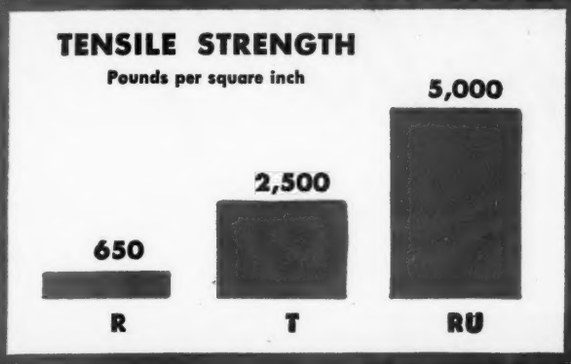
COMPARE Laytex (RU)

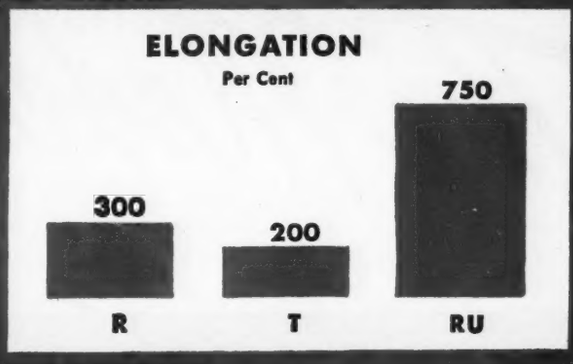
Reg. U. S. Trade Mark

Electrically and Physically

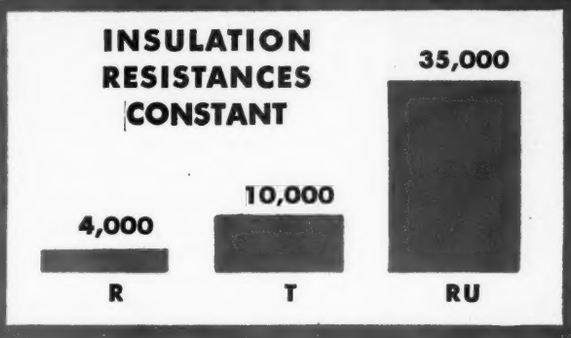
(60° Operation)

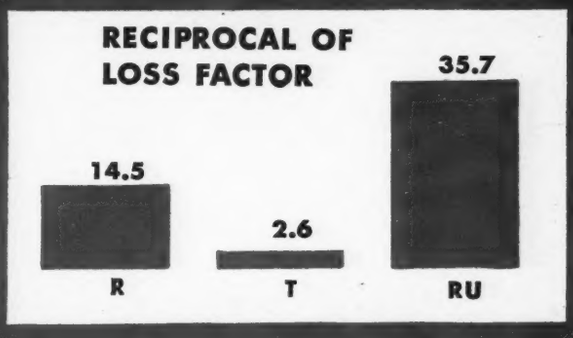
PHYSICAL PROPERTIES





ELECTRICAL PROPERTIES





THREE TYPES of building wire are authorized under the new Electrical Code. These are:

R—Used by the Industry since its inception. The copper conductor has a Code rubber insulation and fibrous overall cover.

T—A copper conductor with VINYLITE (a synthetic compound) insulation.

RU—LAYTEX. This type has a copper conductor, *natural rubber insulation* and fibrous cover.

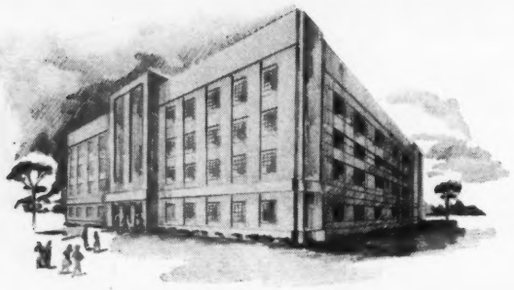
The charts above show the wide margin by which LAYTEX leads in physical and electrical qualities. This is America's lightest weight, smallest diameter, natural rubber covered wire. *Now available without restriction.*

SERVING THROUGH SCIENCE

Nothing Insulates like Rubber

UNITED STATES RUBBER COMPANY

1230 AVENUE OF THE AMERICAS • ROCKEFELLER CENTER • NEW YORK 20, N. Y.



FOR SCHOOL WIRING

The Modern Way is

Simple compression-type coupling replaces dirty, tedious thread-cutting when you use threadless ELECTRUNITE E. M. T. *(Electrical Metallic Tubing). Just slip the coupling on the end of the tube, tighten with a pair of pliers or a wrench, and you have a strong, water-tight joint which will not work loose. It's as simple as that!*

12 Advantages

1. FULL PROTECTION
2. NO THREAD-CUTTING
3. INCH-MARKING
4. LIGHT WEIGHT
5. EASY TO BEND AND REBEND
6. STANDARD FITTINGS
7. EASY TO INSTALL
8. UNBROKEN CORROSION-RESISTANCE
9. KNURLED INSIDE SURFACE
10. UNIVERSAL ACCEPTANCE
11. LOW COST
12. WIDESPREAD DISTRIBUTION

the Electrunite Way

. . . Countless installations prove that THREADLESS ELECTRUNITE E. M. T. meets all safety requirements

Nowhere is adequate wiring protection of greater importance than in school buildings, both large and small. And nowhere will you find a better means of providing such protection than by installing ELECTRUNITE E.M.T.—*the modern streamlined raceway for wiring.*

Basically, ELECTRUNITE E.M.T. is a lightweight conduit, providing all of the money- and time-saving advantages which you get with this type of raceway. But there's more to it than that! ELECTRUNITE E.M.T. is made from costly, cold-rolled steel. Hence it is extra-tough, extra-strong and highly ductile throughout every length.

And don't let anyone kid you about that wall thickness, either. It was not arrived at by guesswork—rather, it was carefully and scientifically determined by Underwriters' Laboratories as being adequate to provide necessary electrical and mechanical protection in every installation. Moreover, ELECTRUNITE E.M.T. is approved by the National Electrical Code for exposed, concealed and concrete slab construction.

Like more information? See your nearest ELECTRUNITE Distributor, or write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

For working in narrow, cramped or hard-to-reach locations, you can't beat ELECTRUNITE E.M.T., with its threadless, easy-to-tighten couplings and box connectors.

Republic
ELECTRUNITE E.M.T.
REG. U. S. PAT. OFF.
LIGHTWEIGHT THREADLESS RIGID STEEL CONDUIT

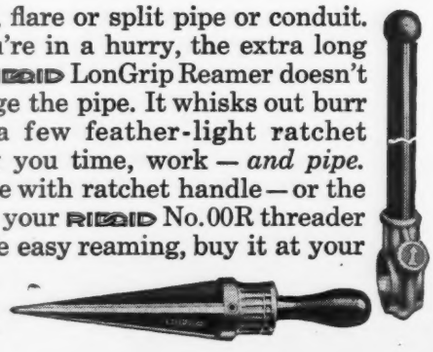
MID AMERICA EXPOSITION CLEVELAND

With this extra-long-taper RIDGID you ream pipe more easily ..quickly.. safely...

Thread pipe faster, with less bother, with these smart, handy, little RIDGID RATCHET THREADERS Nos. 00R and 111R

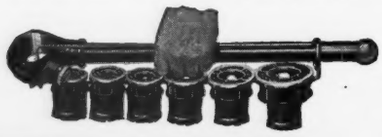
Heads snap in either side... can't fall out

● It won't thin, flare or split pipe or conduit. Even when you're in a hurry, the extra long taper of your RIDGID LonGrip Reamer doesn't gouge or damage the pipe. It whisks out burr cleanly with a few feather-light ratchet strokes, saving you time, work — *and pipe.* Comes complete with ratchet handle — or the reamer unit fits your RIDGID No. 00R threader handle. For safe easy reaming, buy it at your Supply House.



Reamer unit fits No. 00R ratchet threader handle.

● With one of these efficient and tough little steel-and-malleable threaders at hand, pipe from ⅛" to 1¼" is quickly perfectly threaded. Die heads with heat-treated tool-steel chasers snap in from either side, can't fall out. No special dies are needed for close-to-wall threads. Smooth internal ratchet. No. 00R, ⅛" to 1"; No. 111R, ⅛" to 1¼." Handy, fast, durable — try one and you understand their growing popularity. Ask your Supply House.



Free handy carrier for any group of sizes.

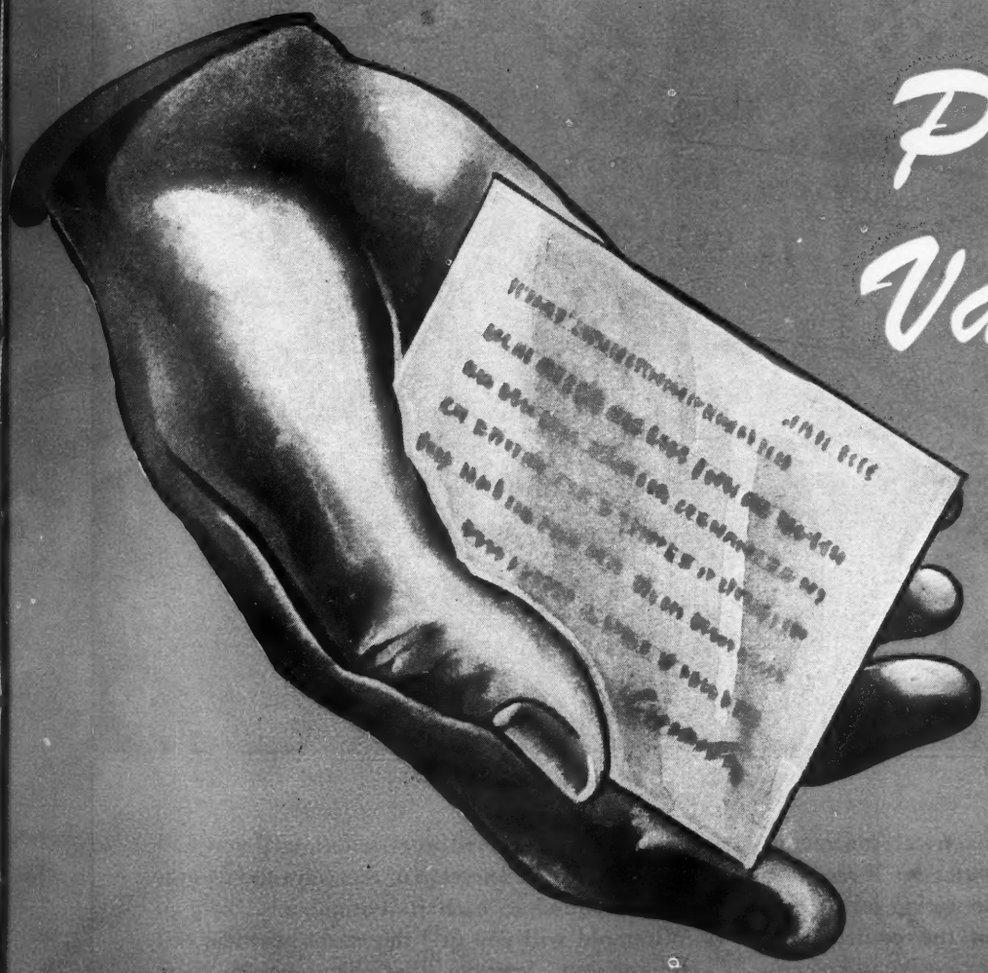
Millions of RIDGID Tools in use

★ RIDGID ★

WORK-SAVER PIPE TOOLS

The Ridge Tool Company
Elyria, Ohio, U. S. A.

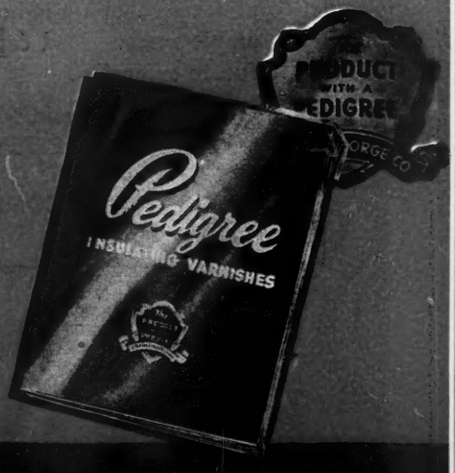
HAND YOUR INSULATING VARNISH PROBLEMS TO US



Pedigree Varnishes

Depend on the Pedigree Industrial Laboratory for help in the formulation of materials for purposes which can not be satisfied by the use of standard varnishes. But first . . . be sure to check the charts in the new Pedigree Catalog. You will probably find the answers to most of your requirements there.

Send for your FREE copy today.



Distributed by

INSULATION MANUFACTURERS CORPORATION
INSULATION AND WIRES INCORPORATED
TRI-STATE SUPPLY CORPORATION

Manufactured by

THE P. D. GEORGE COMPANY, ST. LOUIS, U. S. A.

WIREMOLD SYSTEMS

THE electrical contractor or maintenance man who *knows his Wiremold* is equipped to do an adequate wiring job in *any* type of building . . . to meet *all* the requirements of better lighting . . . more extensive use of appliances . . . plug-in-anywhere convenience . . . ample reserve load capacity . . . provision for future extension.

Only in the 10 basic Wiremold Wiring Systems, with their unique advantages of interconnectability and simplified installation, will you find such freedom in selection of raceways and fittings exactly suited to each individual job. Only in Wiremold will you find the many practical and time-saving features that have made these systems the first choice of experienced wiremen for the past 30 years.

A new Wiremold Wiring Guide will be published shortly in limited edition. Write now to have your name placed on the mailing list.

THE WIREMOLD COMPANY

HARTFORD, 10, CONN.

Know your

WIREMOLD

NEMA

BUSINESS BUILDER IN TODAY'S MARKET FOR ADEQUATE WIRING

Class 2510
Line Voltage
Manual Starter

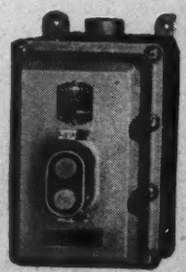
YOU GET PERFORMANCE PLUS WITH THIS MANUAL STARTER!

For push-button control of equipment such as punch presses, fans and blowers, grinders and buffers, these starters give you a lot more than consistent performance. For example—

- **Easy Installation and Maintenance.** Entire switch panel removable for easy wiring. Conveniently located terminals and knockouts.
- **Compact Design.** Starter occupies little space and is easily mounted on or near machine for convenient operation. General Purpose enclosure is heavy gauge sheet steel, finished in attractive machine-tool gray enamel.
- **Overload Protection.** Thermal units, which fit both manual and magnetic starters, protect against harmful overloads but do not trip on normal starting or momentary overloads. "Trip-free" operation prevents holding motor circuit closed against overload.
- **Safety.** Slip-on cover has safety interlock which prevents removal when starter contacts are closed.

CLASS 2510 MANUAL STARTERS are available in both General Purpose and Special Protective enclosures

Water-tight and Dust-tight Enclosure



Enclosure for use in hazardous locations

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Room planned by George Daub, Philadelphia, Architect

"We have other telephone outlets too... right where we need them"

Built-in conduit to carry telephone wires within the walls, with telephone outlets at all handy locations, provides a real convenience for home owners. This feature of good planning and sensible construction is a good idea from your standpoint too.

Many electrical contractors are getting additional business on every residence job — small homes as well as large — by including a bid for installing telephone conduit. Architects, building contractors and buyers can easily be sold the idea because it assures a convenient, attractive, and up-to-date telephone arrangement.

Remember — NO ELECTRICAL CONTRACT IS REALLY COMPLETE UNLESS IT INCLUDES CONDUIT FOR BUILT-IN TELEPHONE FACILITIES.

BELL TELEPHONE SYSTEM

The Bunting Authorized Distributor carries a stock of Bunting products which is geared to the needs of his territory. For Catalog sizes and quantities he is our preferred outlet and your most convenient source for Bunting Precision Bronze Bars, Industrial Bearings and Electric Motor Replacement Bearings. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

Bunting

39

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

NOW YOU CAN "Hang the Sky" TO HELP THEM SEE BETTER

Over-ALL Lighting

by Wakefield

It's brand new— The STAR

Here's the answer for many of your needs. Provides all the advantages of both fluorescent and indirect light plus simple, sturdy construction and easy maintenance. Checked and improved by pre-testing. Unusually simple to handle and clean—just slide out Plaskon reflector section. No need to take unit apart. Ideal for office, drafting room or school. Plan for it on your next job.

It's new — THE WAKEFIELD STAR

BOOST YOUR SALES with a new approach to office lighting

Over-ALL Lighting by Wakefield provides a new method for lighting office interiors and for lighting drafting rooms and schools. A method that makes for easier seeing *and for more business for you!*

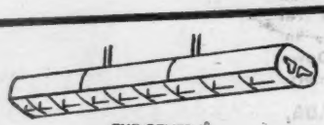
Designed to protect eyes against strain, the new Wakefield Over-ALL Lighting method spreads soft pleasing light *over all.* Your customers will like it because this new system is based on lighting results which mean comfort plus efficiency.

And especially important to you—Wakefield equipment for Over-ALL lighting has been designed to simplify your work . . . through easy installation, easy maintenance and long-lasting service *in addition to top lighting performance.*

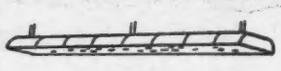
Ask your Wakefield distributor to tell you how Over-ALL Lighting can work for you. The F. W. Wakefield Brass Company, Vermilion, Ohio.

Wakefield

LIGHTING EQUIPMENT FOR OFFICE, SCHOOL AND DRAFTING ROOM



THE GENERAL



THE GRENADIER

THE COMMODORE

THE DIPLOMAT

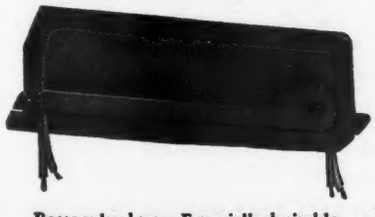
IF YOU SELL FLUORESCENT LAMPS YOU SHOULD SELL ACME FLUORESCENT BALLASTS

Quick-Start [illegible] mp Ballast, for [illegible] g of fluorescent fixtures. [illegible] starter required. Should be used only with Quick-Start lamps.

Selling Acme Electric ballasts goes hand in hand with the selling of fluorescent lamps. Just as fluorescent lamps wear out and must be replaced — so too, the ballast in some fixtures need replacement to provide the kind of quiet, brilliant performance and economy inherent in properly engineered fluorescent lighting.

Acme Electric engineers pioneered many of the important engineering features that helped make fluorescent lighting practical and popular in factories, stores, offices. Balanced secondaries provide for synchronized lighting of multiple lamp fixtures. Vacuum impregnated cores and coils, and compound filled cases minimize magnetic hum. Acme Electric ballasts control the line voltage to provide greater lamp brilliance, long life, better efficiency and performance.

Universal type. Leads can be brought out end of case or bottom of case.



Bottom lead type. Especially desirable for open mounting on top of fixture.

FOR COLD CATHODE LIGHTING

ACME BALLASTS PROVIDE BETTER PERFORMANCE — LONGER LIFE

Standard performance proved designs for 25mm and 22mm 96" long tubes of brilliant light. Get full information about Cold Cathode lighting by writing for Bulletins 162 and 165.

The Acme Electric & Manufacturing Co.
36 Water Street **Cuba, N. Y.**

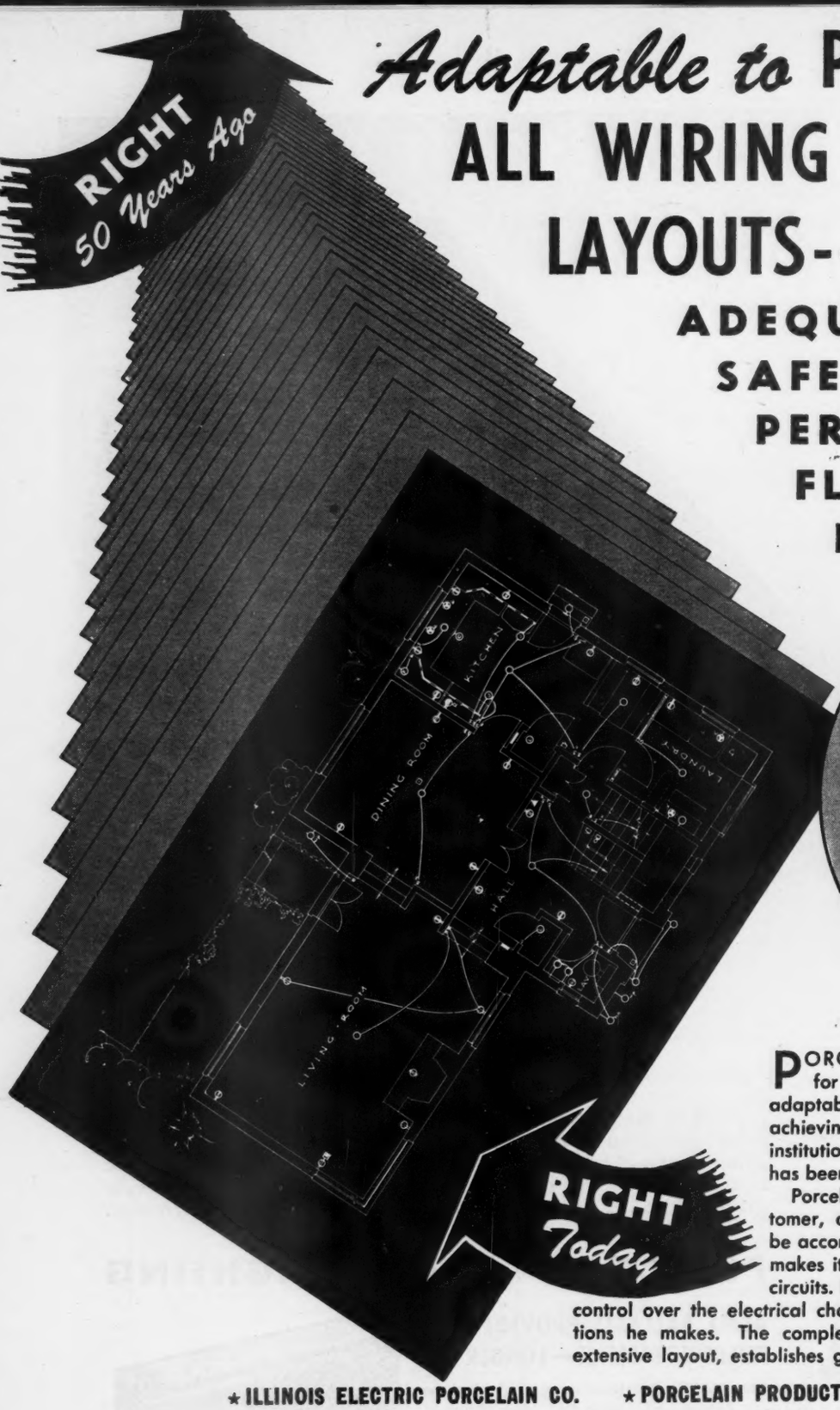
Acme ACME Electric
TRANSFORMERS

Acme Electric also manufactures Luminous Tube Transformers — Cold Cathode Lighting Transformers and Ballasts — Mercury Vapor Lighting Transformers — Radio and Television Transformers — Electronic Transformers — Door Bell, Chime and Signalling Transformers — Safety Transformers — Voltage Regulating Transformers — Step Down Transformers — Control Transformers — Warp-Stop Transformers — Capacitor Transformers for Power Factor Correction.

IN CANADA, Acme Electric & Manufacturing Co. of Canada Ltd.
1434 St. Catherine St., W., Montreal 25, Que.

Adaptable to PRACTICALLY ALL WIRING PLANS AND LAYOUTS---*because of*

ADEQUACY
SAFETY
PERMANENCE
FLEXIBILITY
ECONOMY



PORCELAIN *Protected* WIRING SYSTEMS

PORCELAIN has had widespread recognition for more than 50 years because of its natural adaptability to wiring. It has all the qualities for achieving highly successful residential, commercial, institutional, and industrial installations. That is why it has been so acceptable since wiring was in its infancy.

Porcelain gives the contractor, as well as the customer, definite advantages. Wiring installations can be accomplished in shortest time. The flexibility feature makes it easy at any time to extend systems and add circuits. Porcelain gives the contractor full independent control over the electrical characteristics and workmanship of the installations he makes. The completed installation, whether for cottage or an extensive layout, establishes good customer relations.

★ **ILLINOIS ELECTRIC PORCELAIN CO.**
Macomb, Ill.

★ **PORCELAIN PRODUCTS, INCORPORATED**
Findlay, Ohio

★ **SPECIALTY PORCELAIN WORKS**
East Liverpool, Ohio

★ **SUPERIOR PORCELAIN COMPANY**
Parkersburg, W. Va.

★ **UNIVERSAL CLAY PRODUCTS COMPANY**
Sandusky, Ohio

MODERN PORCELAIN PROTECTED WIRING SYSTEMS

CENLACO (HOT DIPPED)
UNDERWRITERS LABORATORIES, INC. INSPECTED RIGID STEEL CONDUIT
CENTRAL BLACK
UNDERWRITERS LABORATORIES, INC. INSPECTED RIGID STEEL CONDUIT

CENTRAL RIGID STEEL CONDUIT

has pleased a lot of people in over 30 years

"There's Tested Strength in Every Length"

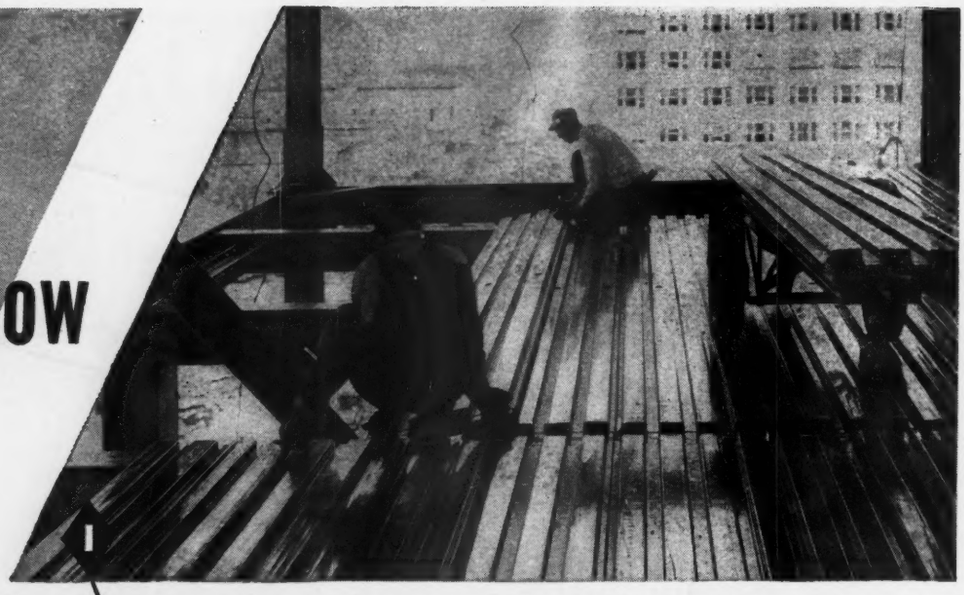
SPANG-CHALFANT

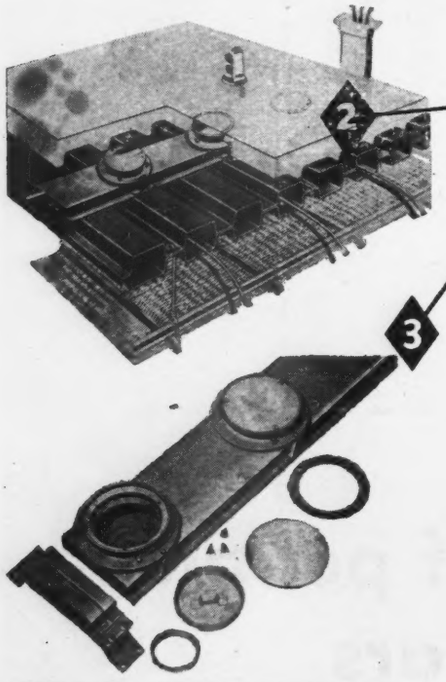
Division of The National Supply Company

General Sales Office: Grant Bldg., Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

Do you know these 3 important facts?





1. **Robertson Q-Floors are the starting point for wiring that's *fully* adequate**
2. **Q-Floor wiring is the *only* way to make the job complete**
3. **Only *General Electric* sells Q-Floor wiring**

It will pay you to remember these important facts whenever you consider the electrical needs of your customer. The cellular steel members of Robertson Q-Floors make ideal permanent raceways for completely flexible and adequate electrical systems. Patented G-E Q-Floor wiring is the only material used to install electrical services in Q-Floors. The combination of these two structural and electrical systems results in an extremely simple and flexible method of supplying the electrical requirements of office buildings, banks, hospitals, industrial plants, and other construction requiring a number of services and 100 per-cent electrical availability.

G-E Q-Floor wiring consists of easily installed header ducts with floor cells located on six-inch centers, thus permitting the use of outlets anywhere in the floor every six inches.

New power, signal and telephone connections can be added at will throughout the life of the building.

Before starting any job involving raceways, building wire or wiring devices, ask your nearest G-E Merchandise Distributor for information on the complete G-E line, or write to Section C-562-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

For Wood and Concrete Floors

G-E Fiberduct underfloor raceways provide full electrical adequacy and flexibility when masonry or wood-type construction is used. Outlets can be preset at the factory or can be added later at any time.

GENERAL ELECTRIC

FEDERAL engineering gives you

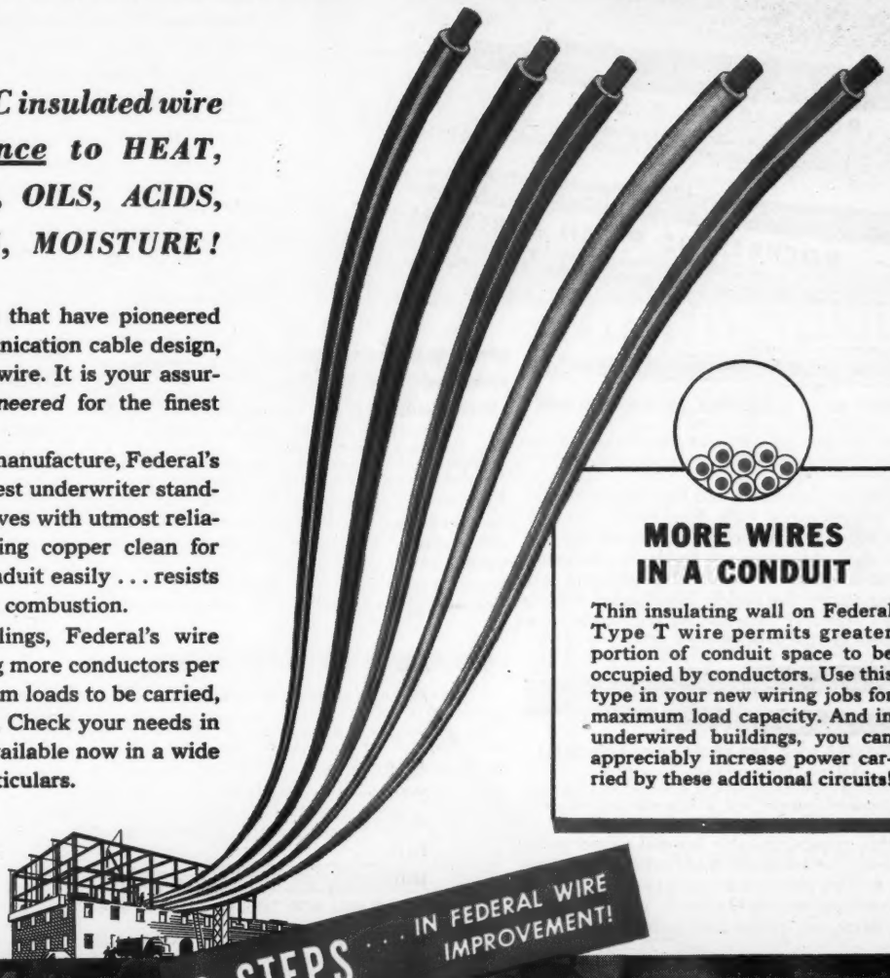
The Latest and Finest in
PLASTIC INSULATED BUILDING WIRE

Type T thin-wall PVC insulated wire with high resistance to HEAT, COLD, OXIDATION, OILS, ACIDS, CHEMICAL FUMES, MOISTURE!

From the same laboratories that have pioneered so many advances in communication cable design, comes this Federal Type T wire. It is your assurance of building wire *engineered* for the finest possible job.

Rigidly controlled during manufacture, Federal's Type T is also tested to highest underwriter standards. In general wiring, it serves with utmost reliability. It strips freely, leaving copper clean for splicing . . . pulls through conduit easily . . . resists abrasion . . . doesn't support combustion.

And in underwired buildings, Federal's wire works wonders . . . permitting more conductors per unit area of conduit, maximum loads to be carried, more circuits to be installed. Check your needs in Type T building wire. It's available now in a wide range of sizes. Write for particulars.



MORE WIRES IN A CONDUIT

Thin insulating wall on Federal Type T wire permits greater portion of conduit space to be occupied by conductors. Use this type in your new wiring jobs for maximum load capacity. And in underwired buildings, you can appreciably increase power carried by these additional circuits!

The finest quality, proved materials are used in Federal wire manufacture. Here, insulation material is being fed to the extrusion machine. Wire emerges from this machine *exactly* as designed . . . built for the job.

Dimensional precision controlled by frequent checks as it comes from extruder. Federal wire is uniform, from one end to the other.

Federal Telephone and Radio Corporation

Export Distributon
International Standard Electric Corporation

Newark 1, New Jersey

An IT&T Associate

FEDERAL TELEPHONE & RADIO FTR

PERMANENTLY INSULATED TO RESIST HEAT FUMES - OIL - GREASE - MOISTURE - FLAME

From the three basic designs illustrated Rockbestos has developed a complete line of 125 failure resisting wires, cables and cords, a few of which are described. All have the same performance guaranteeing characteristics detailed below. Write for catalog or samples.

Rockbestos Permanent Insulation Insures Long-Lived Service

1. A tough impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease, alkalies and corrosive fumes.
2. Felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out with age, burn, or bake brittle under high temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance — protected from heat, flame and oxidation by felted asbestos walls.
4. Impregnated asbestos insulation that withstands heat of overloads and aging and won't become brittle, crack, rot or burn.
5. Conductors are perfectly centered in helically applied non-flowing insulation and will always remain so.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)

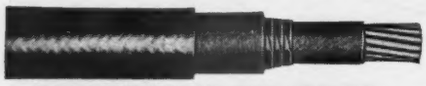
Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same characteristics.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA)

Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

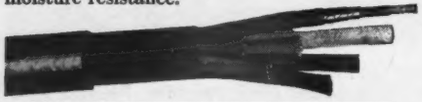
Use this apparatus cable for coil connections, motor and transformer leads exposed to overloads or high ambient temperatures. It makes a permanent installation as it is resistant to heat, flame, oil, grease and moisture.



ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

Sizes No. 18 AWG to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 5000.

This cable is recommended for power leads of heat-exposed equipment and circuits that run near boilers, steam lines, furnaces, kilns and other hot spots. It withstands high ambient and conductor temperatures and has ample moisture resistance.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

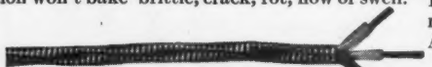
In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for applications requiring a multi-conductor control cable capable of withstanding high temperatures, corrosive fumes, oil, grease and moisture. It also eliminates fire hazard as it will not burn. Used by equipment manufacturers, power companies, steel mills.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used wire is ideal. Its permanent insulation won't bake brittle, crack, rot, flow or swell.



ROCKBESTOS THERMOSTAT CONTROL WIRE

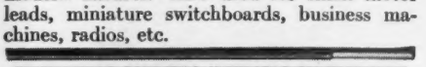
Sizes No. 14, 16 and 18 AWG in two to six conductors with .0125", or .025" or (for 115 volt service) .031" of impregnated felted asbestos insulation and steel armor.

A multi-conductor control wire for low voltage inter-communicating, signal, and temperature control systems. Heatproof, fireproof insulation and rugged steel armor give troubleproof circuits.

ROCKBESTOS 300 VOLT HEAT RESISTING FIXTURE WIRE
(Underwriters' Type AF)

Sizes No. 10 to 18 AWG stranded plain copper conductor insulated with black or white impregnated felted asbestos—with or without braid.

Rockbestos asbestos insulated fixture wires, approved by the Underwriters' Laboratories, are ideal for lighting fixture wiring because their heat resistant insulation will not bake out under the high socket temperatures developed in modern fixtures. Also used for small motor leads, miniature switchboards, business machines, radios, etc.



ROCKBESTOS ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect motors against heat-induced breakdowns with class B windings of this heat resisting magnet wire. Leads of Rockbestos A.V.C. Motor Lead Cable will complete the failure-proofing.

ROCKBESTOS A.V.C. 600 VOLT FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos, varnished cambric, felted asbestos, covered with heavy impregnated asbestos braid.

A heavy duty, high-dielectric, heat and moisture resistant flexible cord used in locomotive cab circuits, high wattage lighting units, floodlights and for leads on apparatus exposed to heat. Specify polarized conductors if desired. For high temperature applications where resistance to moisture is not required specify All-Asbestos insulated constructions.

ROCKBESTOS 300 VOLT HEAT RESISTING DUPLEX FLEXIBLE CORD
(Underwriters' Type AFPD)

Sizes No. 10 to 18 AWG stranded plain copper conductors insulated with impregnated felted asbestos, polarized, twisted together and covered with a cotton braid.

This heat-resisting cord is approved for use in lighting fixtures and is recommended for pendant types as it does not dry out or crack at the socket. Also on apparatus and appliances which develop heat in operation or are used in hot, dry places. Twisted pair, tripled or triplex constructions also available.

ROCKBESTOS ALL-ASBESTOS 600 VOLT RHEOSTAT CABLE
(National Electrical Code, Type AI)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this cable for wiring rheostats, switchboards, elevator and locomotive control panels and equipment exposed to heat, fumes or fire hazard — also for open power circuits in hot, dry locations. For flexible conductor specify Rockbestos All-Asbestos Flexible Apparatus Cable — for solid conductor, Rockbestos All-Asbestos Rheostat Wire.

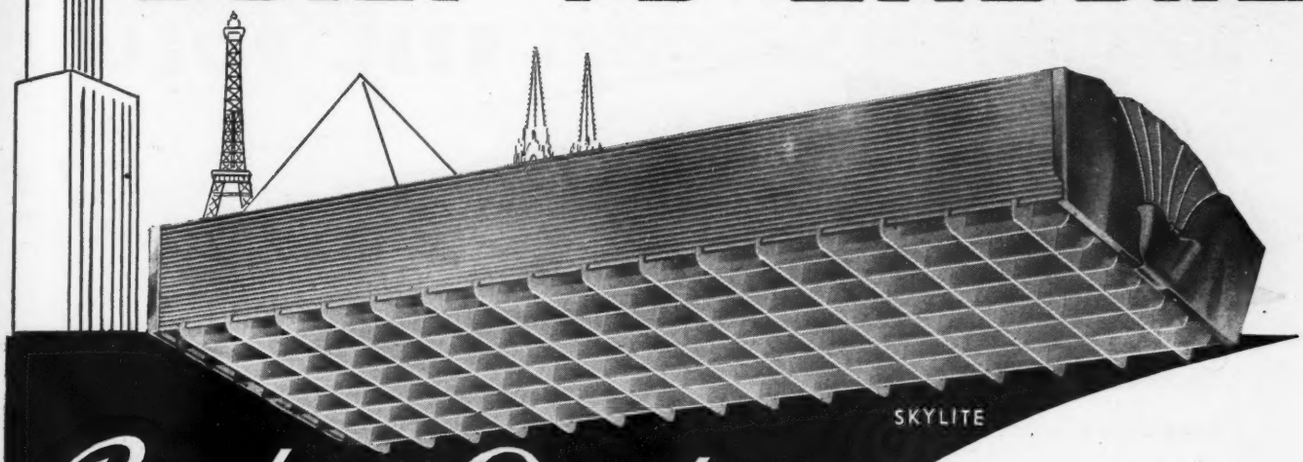
ROCKBESTOS PRODUCTS CORP., 203 Nicoll St., New Haven 4, Conn.

125 STANDARD TYPES

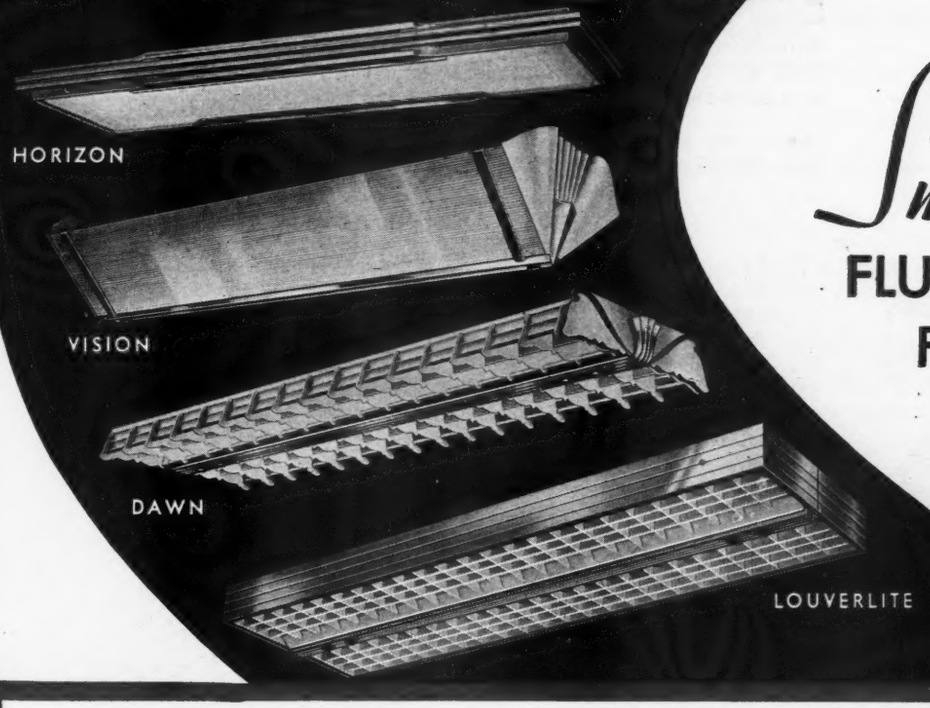
ROCKBESTOS

The Wire with Permanent Insulation

BUILT TO ENDURE



Built-in Quality— distinguishes every *Smithcraft* FLUORESCENT FIXTURE



A complete line of commercial and industrial fluorescent fixtures

Every SMITHCRAFT FLUORESCENT LIGHTING Fixture is built to meet the most rigid tests of ENDURANCE. Of course, there is also Style . . . recognized as the industry's top styling . . . and there is correct Engineering for which Smithcraftsmanship is notable. To these Smithcraft has added a built-in quality which guarantees you that ENDURANCE which makes firm friends and gives almost limitless service.

When you recommend SMITHCRAFT FLUORESCENT LIGHTING FIXTURES, you are performing a real service to yourself, to your customers, and to the cause of Better and More Economical Lighting.

Smithcraftsmanship is obtainable only in Smithcraft Fixtures.

Distributed only through recognized electrical wholesalers

Smithcraft LIGHTING DIVISION Chelsea 50, Mass.

IMMEDIATE SHIPMENT · · AUSTIN

REEL ROLLER

(PATENT PENDING)

$37.50 ea.

2% Cash 10 days; Net 30 days
F. O. B. Chicago, Illinois

FOR DISPENSING ANY MATERIAL THAT IS WOUND ON A REEL

The new quick, easy and safe way. Reel is loaded in a jiffy with little or no effort. Requires a minimum amount of valuable floor space.

EVERY Electrical Contractor, Utility, REA Co-operative, Shipyard, Railroad and Wholesaler, should have several of these indispensable AUSTIN REEL ROLLERS. When pulling one or more cables into conduit, use an AUSTIN REEL ROLLER for each cable. Can be mounted stationary; or used on the job as a portable device—ideal for service and repair trucks.

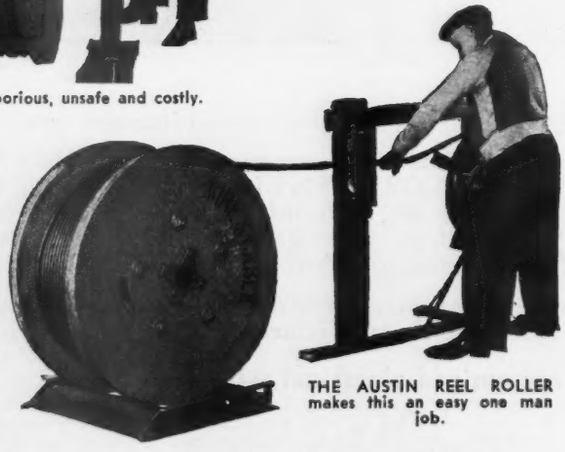
Here's the best, the most economical investment you ever made—AUSTIN NO. 600 REEL ROLLER at $37.50 each. Prompt shipment.

9 OUTSTANDING ADVANTAGES

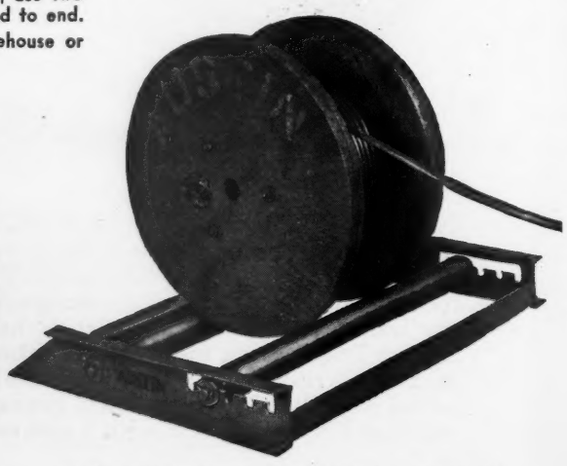
(1) Ramp—Makes it quick and easy to load the reel onto the rollers.
(2) Back roller is mounted slightly higher, preventing the reel from being pulled off the roller when cable is removed.
(3) Reel rolls on grease packed flanged ball bearings with the greatest of ease and safety.
(4) Thumb screw, which when tightened, prevents roller from turning for easy removal of reel.
(5) Hole for lag screw, one in each corner for stationary mounting.
(6) Heavy steel frame, painted bright orange, not only adds to its appearance, but, also makes it readily visible on the floor which helps to eliminate accidents.
(7) Five adjustable slots to accommodate various reel diameters. No screws, washers or cotter pins to remove—simply raise up the roller and slide into the slot required.
(8) Will take any size reel up to 30" in width. For larger reels, use two reel rollers and mount end to end.
(9) Can be used in the warehouse or on the job.

The old way—laborious, unsafe and costly.

AUSTIN REEL ROLLERS, like all AUSTIN Products, are sold exclusively through your Electrical Wholesaler. Send him your order today.



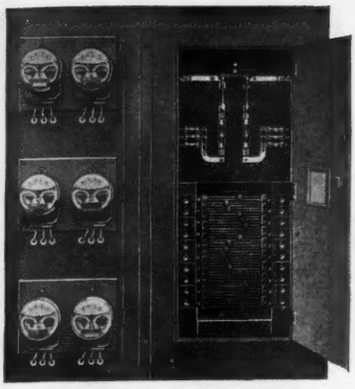
THE AUSTIN REEL ROLLER makes this an easy one man job.



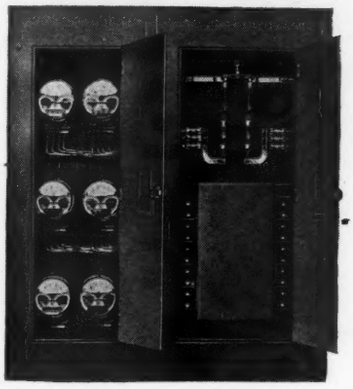
Note the roller adjustment for this small diameter reel.
MAXIMUM CAPACITY 4000 LBS. WEIGHT 75 LBS.

THE M. B. AUSTIN CO.

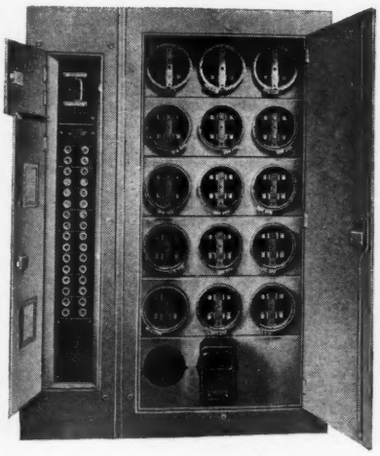
108-116 S. DESPLAINES STREET
CHICAGO 6, ILLINOIS

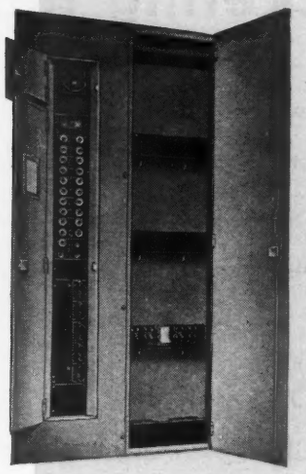


Wurdack Bar Type Meter Control Panelboard



Wurdack Wire Type Meter Control Panelboard





Check Meter Type Panelboards

GETTING YOUR SHARE OF COMMERCIAL MODERNIZATION INSTALLATIONS?

Wurdack offers you complete meter control panelboard assemblies

Wurdack Meter Control Panelboards are especially fabricated as *complete* units to provide you with easy installations that enable you to do the job better and profitably.

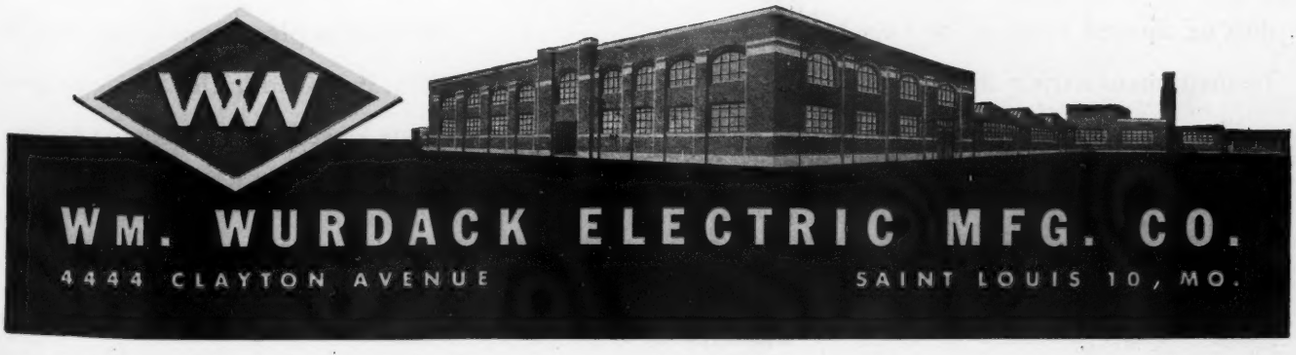
Their compactness and versatility is demonstrated in some of the units shown here. Tenant circuits are quickly changed and added to without discontinuing or disrupting main service and without rewiring.

Wurdack Check Meter Type Panelboards

Preferred in housing projects or commercial installations by architects, engineers, and contractors because they are complete unit assemblies, "custom-made" to fit the particular job.

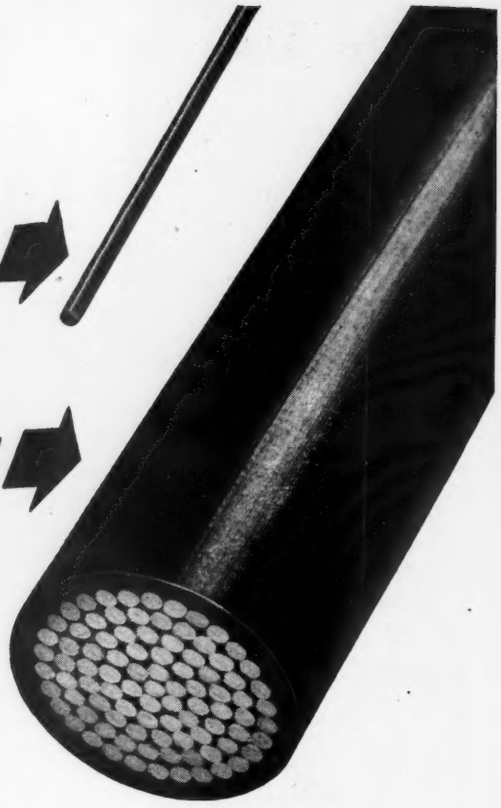
The Check Meter Socket Type and Check Meter Wire Type Panelboards as shown here indicate the ability to confine distribution centers of this type in a minimum of space without additional installation expense.

Specifications and prices will be sent to you upon request.



It's so-o-o small

It's so-o-o big



Insulation and jacketing made from Geon

SLIP-ON spaghetti for radio hookup wire on the left—insulated 2,000,000 circular mil cable on the right—show the broad range of applications for insulation made from GEON.

This versatility is possible because of GEON's many unusual and valuable properties. Excellent electrical properties lead the list, of course. And that permits a thinner coating of insulation. That, in turn, means more conductors per conduit or smaller holes to be bored. In instrument wiring it means easier handling, faster work. Insulation made from GEON resists most normally destructive factors—oil and grease, acids and most other chemicals, ozone, sunlight, aging, abrasion, flexing, heat, cold, water, and many others. And it can be brilliantly—and permanently—colored in the entire NEMA range.

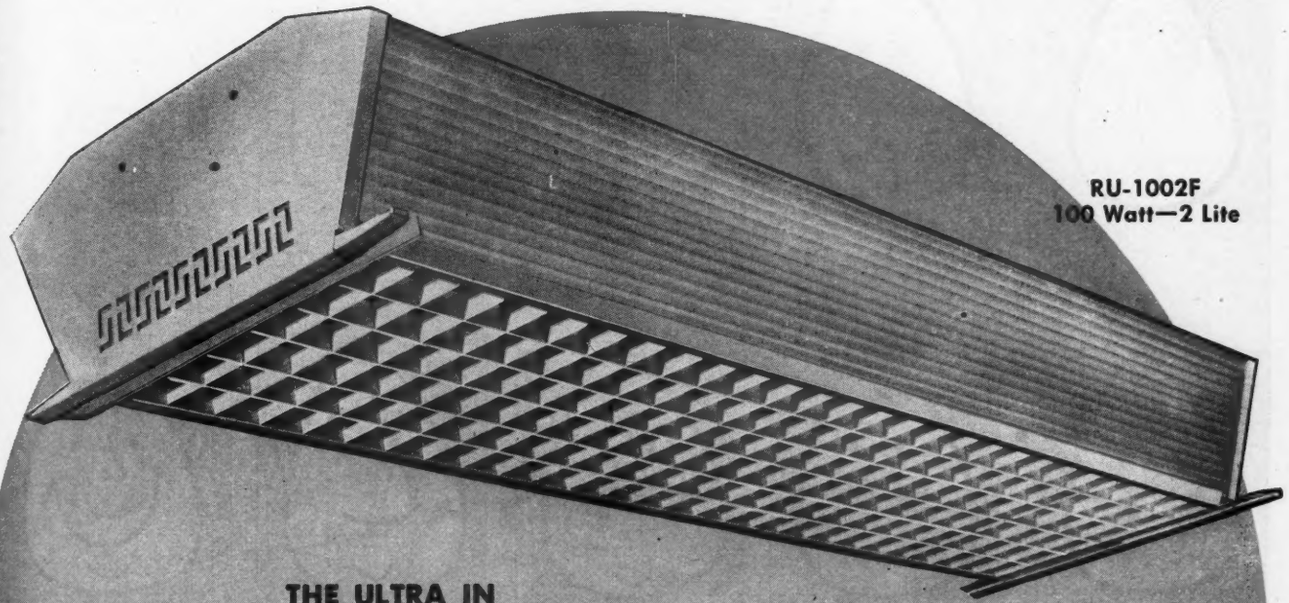
Wire insulated with GEON is now being made by leading wire and cable manufacturers. The next time you order wire—for instrument, industrial, domestic, or utilities wiring, be sure to specify *wire insulated with GEON.* For more information please write Department Y-5, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio In Canada: Kitchener, Ontario.

Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

Specify *All-bright* SKYLIGHT

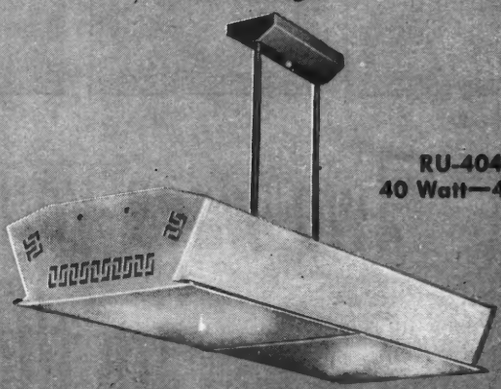
for better light . . . for easier maintenance



RU-1002F
100 Watt—2 Lite

THE ULTRA IN FLUORESCENT LIGHTING

Our engineers have designed the "Skylight" fluorescent fixture to achieve 10 to 20 more foot-candle than any other fixture known of similar design. All the elements of modern design, high efficiency and low maintenance costs have been incorporated . . . offering high intensity illumination with minimum glare. Available with egg-crate or honeycombed louvres. Fixtures can be mounted either individual or continuous row—flush or suspension. *For better sight, it's All-bright!*



RU-404S
40 Watt—4 Lite

RU-402S
40 Watt—2 Lite

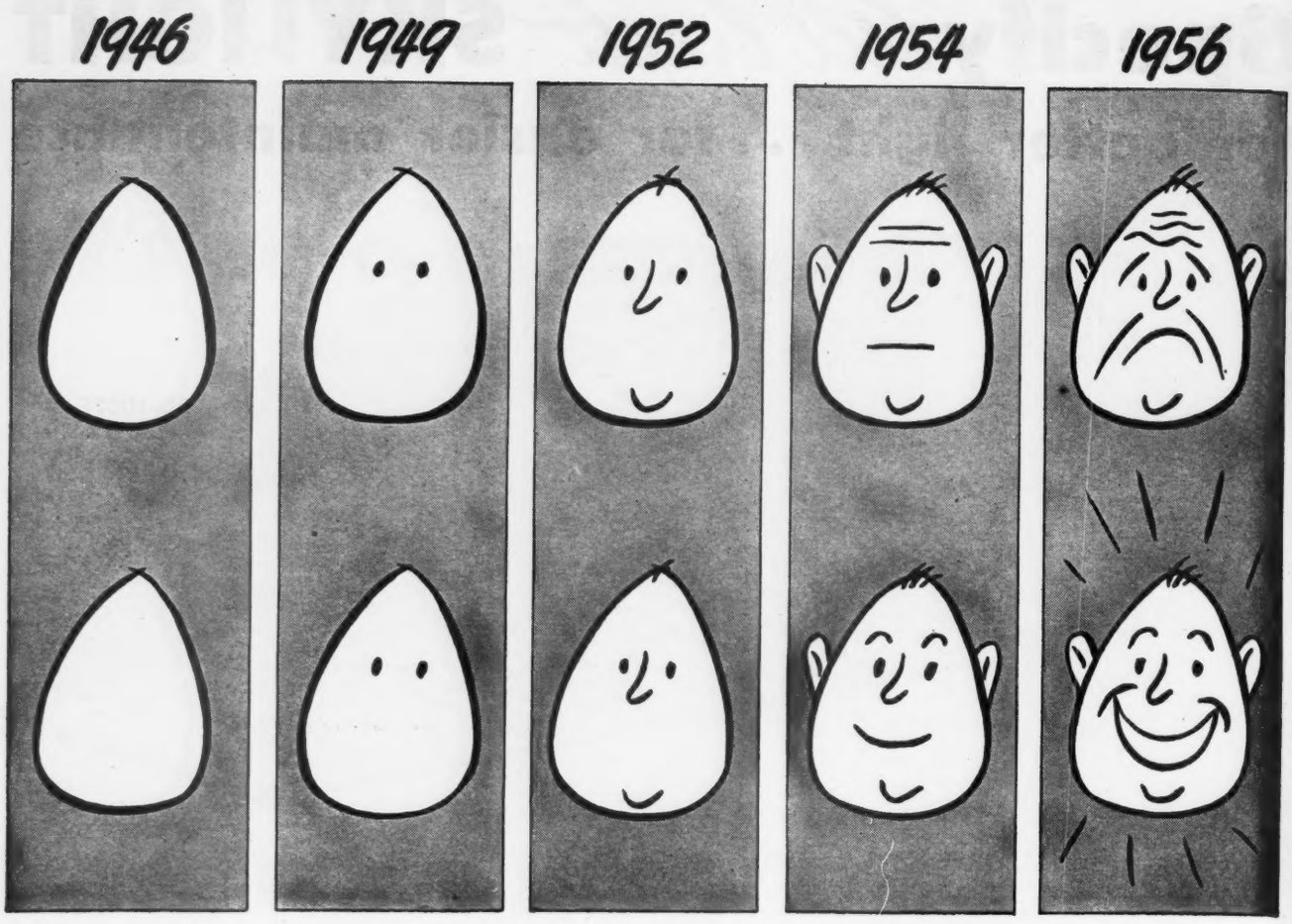
Send for new SKYLIGHT *catalog*

Union Made—I. B. E. W.

ALL-BRIGHT ELECTRIC PRODUCTS COMPANY

Manufacturers of Fluorescent Lighting Fixtures

3917 N. Kedzie Ave. Chicago 18, Illinois



Two ways your face can grow in the next few years

USUALLY, our faces show what's happening to us. For instance, suppose financial matters are constantly on your mind.

Suppose you know that there's practically no cash reserve between you and trouble.

It would be surprising if your face didn't show it.

But suppose that, on the contrary, you've managed to get yourself on a pretty sound financial basis.

Suppose that you're putting aside part of everything you earn . . . that those dollars you save are busy earning *extra* dollars for you . . . that you have a nest egg and an emergency fund.

Naturally, your face will show *that*, too.

There's a simple and pretty accurate way to tell which way your face is going to go in the next few years:

If you are buying, regularly, and holding as many U. S. Savings Bonds as you can, you needn't worry.

Your face will be among the ones that wear a smile.

Buy all the Bonds you can... keep all the Bonds you buy

ELECTRICAL CONTRACTING

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

TO HELP REWIRE AMERICA— ADEQUATELY

The key to electricity's door-of-opportunity is Adequate Wiring — from the smallest wires for residential service to the largest cable supplying power for an entire City.

These new Hazard booklets — *yours only for the asking* — describe and will help you to select the correct, time-proved insulated cables needed for any Adequate Wiring program.

Send immediately for your copies of these bulletins — if you have not already received them — and ask us to put your name on the mailing list for others that will follow in this comprehensive series. Just write the Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD CABLES

for every electrical use

4555

HOUSING CAN COST TOO MUCH

EVERYONE in the United States wants our people, and particularly our war veterans, well housed quickly. Almost everyone, we believe, likes the vigor and imagination with which Wilson W. Wyatt, the housing expediter, is going about the job of mobilizing our housing resources.

No one, however, wants the veterans, or anyone else, to get a lot of severe economic headaches along with the housing. As it stands, the emergency housing program runs unnecessary risks of having such results.

Here are the reasons:

1. The principal opportunity the program offers to the veteran is that of buying a high-cost house where a chance to rent would, more often than not, meet his needs much better.

2. At the worst possible time, the program adds substantially to the dangers of a runaway inflation of the sort that inevitably ends in a crash.

3. Little is done to try to reduce the arbitrarily high costs of building, such as those resulting from restrictions imposed by labor unions and antiquated building codes.

4. By giving overriding priorities to unattainable goals of home construction, the program endangers a volume of industrial construction necessary to sustain full employment.

Needs of Veterans

First on the needs of the veterans. What many, if not most, veterans need is a chance to rent a place at a reasonable rental while they are getting shaken down in their postwar careers which in many cases are inevitably unsettled at this time. Essentially, what the "Veterans Emergency Housing Program" gives them is a chance to buy, for about $6,000, a house built along conventional lines and padded with much unnecessary labor and material cost.

But what are the alternatives? There are at least two. One is to put far more emphasis on more effective use of existing housing than the Wyatt program has thus far. The other is to see that the proportion of new rental units is much stepped up.

Incredible as it may seem, there are at present more than 2,000,000 vacant dwellings in the United States. Many of them should be demolished. But many permit of relatively satisfactory temporary use. Many more single dwellings can readily be converted into comfortable multiple dwellings. The emergency program assumes that only 350,000 dwelling units can be provided this year by these expedients, but it does not seem unreasonable to assume that this figure might be doubled by a vigorous drive. The result would be a better balanced emergency housing program, because it would provide more rental housing immediately and save critical building materials.

Of the new housing units contemplated by the Wyatt program, it is estimated that only about 20 per cent will be for rent. Before the war more than half of the homes in the United States were rented. That means that unless the Wyatt program is to create little less than a revolution in the terms on which homes are occupied, it must be revised to include a much higher proportion of rental units.

To secure the result in the face of present high building costs special inducements will be required. They might be provided by allowing accelerated tax amortization of, say, half the construction cost over the next five years, together with rent ceilings high enough to make this form of investment attractive. This would, of course, call for higher rents, but the actual price to the veteran, in woe as well as money, might well be much less in the long run than if he bought an over-priced house now.

Too Easy To Pay Too Much

One of the mysteries of the Wyatt program is its general emphasis on measures to increase the supply of money with which to buy houses when the demand for houses is already at an all-time high. Some veterans may need special financial help, but the plan to give 90-95 per cent mortgages generally on new homes is not only unnecessary but positively dangerous. By providing up to $3.5 billions of government-guaranteed credit for homes this year, and almost twice as much in 1947, the program will release an equivalent amount of individual savings to create further demand for goods and services. All that such generous mortgage terms will accomplish with certainty is a dangerous lengthening of the odds that we will not avoid a boom and bust cycle of inflation.

If building codes were brought up to date and arbitrary union working restrictions were eliminated, the way would be paved for reductions in the price of standard houses which, it has been estimated, might run as much as 20 per cent. This would both give the buyer of a new house a far better run for his money, and also reduce the inflationary pressure created by the super-generous credit arrangements involved.

Getting anything done along this line is difficult, particularly because the restrictions are imposed by tens of thousands of separate localities and organizations. Some headway is being made. The local emergency housing committees being set up under the Wyatt program provide a means of doing much more. Far more steam must be put behind this aspect of the program, however, if its greatest potentiality for permanently constructive accomplishment is to be realized.

Crippling Essential Industrial Production

The goals set for emergency housing construction —1,200,000 new homes started this year and 1,500,000 started in 1947—are higher than any qualified authority thinks can be met without crippling other essential construction. The reasons commonly assigned for such optimistic goals is that they are inspiring to those in the industry and soothing to those who want something tremendous done about housing.

Under normal circumstances, relatively little damage might be done by such excessive goals which are a common feature of most Washington programs trying to elbow their way to the center of the national stage. However, the emergency housing program carries with it top priorities for the materials to be used. Consequently, other essential construction will have to get along on whatever share of critical building materials will be left after all demands of home builders have been satisfied.

The Civilian Production Administration estimates that output of important materials will fall far short of needs. It forecasts a 15 per cent deficit in lumber, 18 per cent in bricks, and 52 per cent in cast iron radiators. Hence, unless building materials output can be stepped up far more rapidly than now seems possible, a prohibitive squeeze will be put on industrial building to provide the materials needed for the Wyatt program. This would complicate unbearably the problems of sustaining full employment and getting the flow of production so important in avoiding the boom and bust route.

Perspective on the Housing Shortage

What is needed is an aggressive drive to get full production of building materials as rapidly as possible. Such a drive should concentrate on measures aimed at helping the industry remove the obstacles to all-out production rather than on such measures as the subsidy plan which seems quite likely to succeed only in enmeshing the industry in more government controls. After making due allowance for the materials outlook and the needs for essential non-housing construction, housing goals should then be set as high as feasible. As matters stand, by setting construction goals before feasible material goals are determined, the cart is put before the horse.

There can be no doubt about the acuteness of the housing shortage and the necessity of a program commensurate with the magnitude of the problem. It also remains true, however, that the housing shortage for the nation as a whole is not quite as desperate as those who want the country to drop everything and go to building houses would have us believe.

During the war 3½ to 4 million new dwelling units were built or created by remodelling in other than farm areas. The number of families living in such areas increased by less than 3½ million. Even though some of this housing was located in remote places as an adjunct of war production works, the wartime increase permitted a margin for more housing per family at this time. Indeed, it has been estimated that the rate of doubling up is only about one-third as great as in 1940. The margin did not begin to suffice, however, to meet the needs of those millions of people particularly in the lower income groups who, thanks to rapid increases in income, can afford to have and insist upon having better housing than they have ever had before.

A rising standard of income which makes possible a new standard of housing for many people is a fine thing. Above all, it is important to see the veterans get the best possible break in housing.

But Housing Can Cost Too Much

The Wyatt program has many good features. The emphasis on prefabrication, though perhaps overoptimistic, is hopefully modern. The emphasis on local collaboration in solving housing problems which are inevitably in large part local should lead to permanently valuable results. The vigorous mobilizing of 300,000 temporary dwellings to meet at high speed some of the most desperate shortage is all to the good.

The main trouble with the program is that it does not pay enough attention to the economic havoc which may be created in the process of trying to meet its excessive goals. As a nation, we should be and are willing to pay a high price to get adequate housing. But the price will be too high if we:

1. Give the veteran a bad bargain by selling him an over-priced house.
2. Cripple industrial production needed to create good jobs for veterans, and
3. Touch off a disastrous inflationary sequence in the process.

These pitfalls can be avoided. All of us, including the veterans, have a common interest in seeing that they are avoided.

President, McGraw-Hill Publishing Co., Inc.

New!

IDEAL INSULATION RESISTANCE TESTER

Has wide variety of uses in testing and measuring insulation resistance!

Detects the weak spots in your electrical insulation *before* they can cause trouble — costly delays — expensive repairs. The NEW IDEAL Insulation Resistance Tester is always "on guard", one-step-ahead in preventing breakdowns, when you regularly check the insulation resistance, in all types of electrical circuits and equipment.

Entirely self contained—no batteries or external power supply to bother with — no brushes or commutators to require attention. Power is provided by small internal hand generator operated by slowly turning a crank. Always ready for instant use. Connect leads to the apparatus to be tested, turn crank and the correct test voltage is indicated by two small button lights. Range 0 to 100 megohms.

Write for FREE Bulletin

Motor Equipment Division

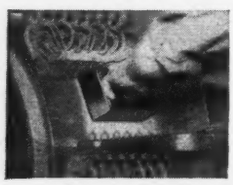
IDEAL INDUSTRIES, Inc.

(Successor to Ideal Commutator Dresser Co.)

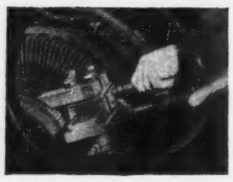
1041 PARK AVENUE SYCAMORE, ILLINOIS

IDEAL
MOTOR MAINTENANCE EQUIPMENT

IDEAL Resurfacers remove pin ridges, roughness and small flat spots from Commutators and Slip Rings with armature rotating on its own bearings.



IDEAL Precision Grinders restore surfaces that are badly scored and out-of-round. Easy to mount directly on motor frame. No dismantling necessary.



IDEAL Mica Undercutters undercut hardest mica, without taking down either motor or generator.

1640

Send for FREE Motor Maintenance Handbook

PROMPT DELIVERY

MAY . . . . at a Glance

United Nations

The eyes of the world are focussed on a gymnasium at Hunter College in New York. Converted in 15 days to a council chamber for the United Nations, it houses the deliberation of a handful of men who are writing the future history of mankind. The conversion involved one of the most interesting electrical jobs of the day. Hugh Scott and electrical contractor Bernard Eichwald give you the story in this issue, page 59.

Lighting Show

Our thanks and best wishes to the many good friends who paid a visit to our booth at the International Lighting Exposition in Chicago last month. It was a source of great inspiration to all of us, and we revelled in hours of shop talk with folks who share our enthusiasm for this old industry, its works and its destiny. It was a great personal experience. It was a great show.

Materials

Familiar wartime experiences like "critical materials" and "short supply" are still with us. We are due to hear them a lot more in connection with building during the coming months. The civilian production administration, which has the job of speeding up reconversion and opening up bottlenecks in production is optimistic but cautious. There is a lot of production, but, like one flat tire in a tunnel full of traffic, little shortages can dam up the flow. Right now non-ferrous metal is a major problem which can and probably soon will cramp the production of many electrical materials. With more people actually at work than at the peak of the war production, once the little barriers can be swept away we can expect materials to pour forth in great abundances.

Range Wiring

High prices quoted for installing ranges and water heaters in some areas are worrying utility and merchandising people. They say installation costs threaten to price major appliances out of competition. Attempts to negotiate low prices before substantial volume permits streamlining the work are likely to fail. With present material supply problems, few contractors are anxious to take on range wiring, their bids are likely to be high. Given time, and improved supplies, however, such plans as those in operation in Youngstown and St. Louis pre-war will be revived. Through methodical scheduling and production methods, they achieved good installations at low cost.

NISA

Motor shop executives from all over the country converged on Tampa last month for the first post-war convention of the National Industrial Service Association. It was a full program for a record breaking attendance. B. C. Cooper's notebook and camera give you the report beginning on page 64.

Training Credit

Everyone admits that service acquired training in electrical work deserves consideration in apprentice training schemes and state license requirements. Minnesota has developed a practical schedule for coordinating service training and other experience into a logical and fair system of credits. The plan ought to be adopted in other states. See "G. I. Skill Credits," page 78.

Insulation

Type T wires are meeting some rugged tests in use that show the way to solving some difficult insulation problems in areas where wires must withstand the effect of destructive chemicals. A plant of the B. F. Goodrich Chemical Company has been a proving ground for wire insulation under some of the worst conditions likely to be encountered. See "T Can Take It," page 70.

Adequate Wiring

House wiring is as big a market as we are willing to make it. Never before have we had such powerful support for good wiring as we have today from the National Adequate Wiring Bureau and the local adequate wiring bureaus established in many principal cities. "Helps For House Wiring," page 68, gives a quick picture of some of the material available to contractors in approaching the huge residential job ahead.

Cover Picture

Ex-marine J. H. Terhune is back at his old job with W. W. Tarrant Electric Machinery Company, Wichita, Kansas, after almost two years in the Pacific. He's stripping the stator of a 75 hp., 900 rpm. explosion-proof motor from an oil refinery. The photo was shot by Midwest editor Gus Eckel on a recent field trip through Kansas and Oklahoma.

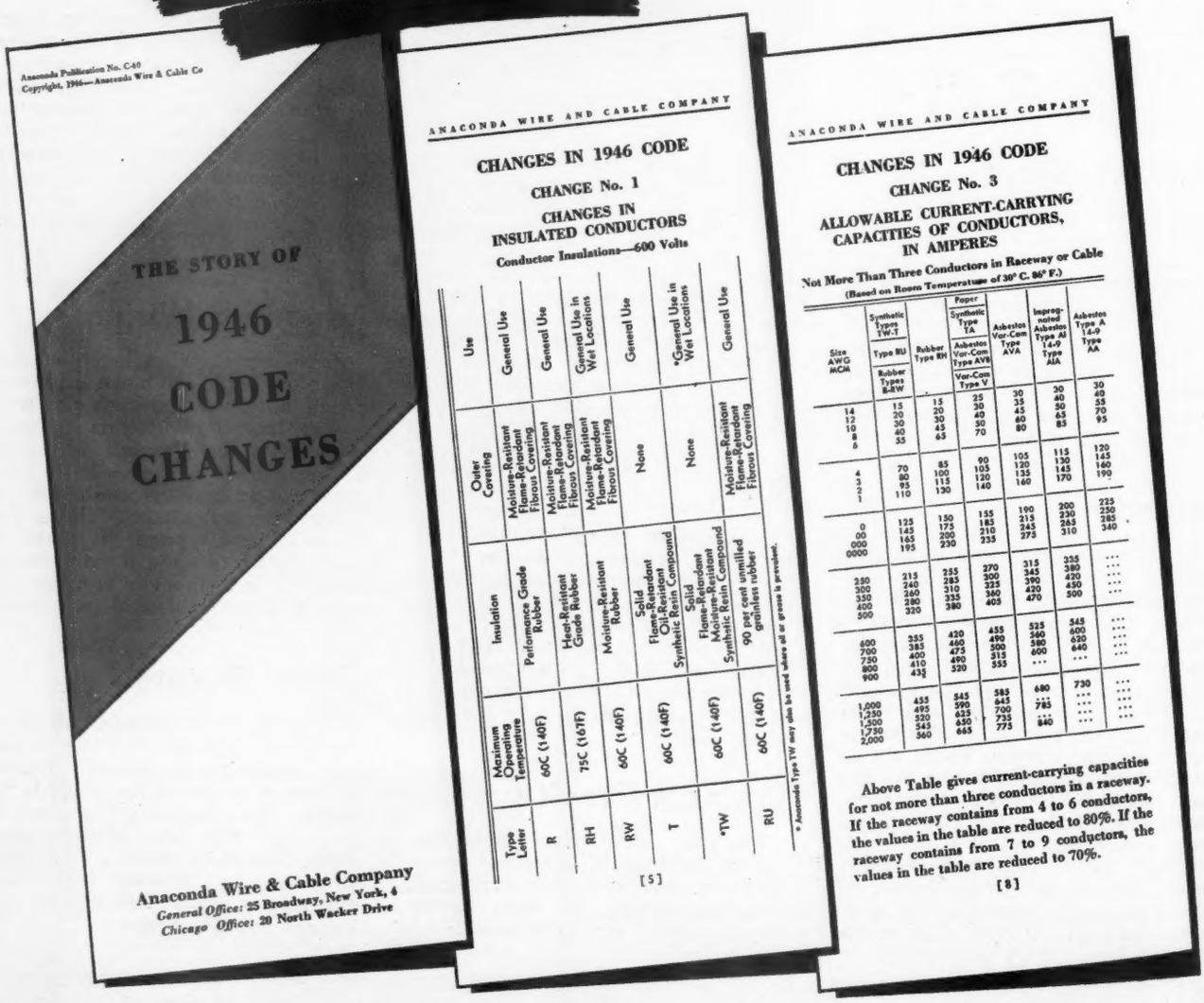
Your Anaconda Distributor has

ADVANCE INFORMATION ON THE 1946 CODE

PERTAINING TO ELECTRICAL CONDUCTORS

In handy Booklet Form

YOURS for the asking


Anaconda Publication No. C-40
Copyright, 1946—Anaconda Wire & Cable Co
THE STORY OF
1946
CODE
CHANGES
Anaconda Wire & Cable Company
General Office: 25 Broadway, New York, 4
Chicago Office: 20 North Wacker Drive
ANACONDA WIRE AND CABLE COMPANY
CHANGES IN 1946 CODE
CHANGE No. 1
CHANGES IN
INSULATED CONDUCTORS
Conductor Insulations—600 Volts
Type Letter
Maximum Operating Temperature
Insulation
Outer Covering
Use
R
60C (140F)
Performance Grade Rubber
Moisture-Resistant Flame-Retardant Fibrous Covering
General Use
RH
75C (167F)
Heat-Resistant Grade Rubber
Moisture-Resistant Flame-Retardant Fibrous Covering
General Use in Wet Locations
RW
60C (140F)
Moisture-Resistant Rubber
None
General Use
T
60C (140F)
Solid Flame-Retardant Oil-Resistant Synthetic Resin Compound
None
•General Use in Wet Locations
•TW
60C (140F)
Solid Flame-Retardant Moisture-Resistant Synthetic Resin Compound
Moisture-Resistant Flame-Retardant Fibrous Covering
General Use
RU
60C (140F)
90 per cent unmilled grainless rubber
• Anaconda Type TW wire also has cured where oil or grease is present.
[5]
ANACONDA WIRE AND CABLE COMPANY
CHANGES IN 1946 CODE
CHANGE No. 3
ALLOWABLE CURRENT-CARRYING CAPACITIES OF CONDUCTORS, IN AMPERES
Not More Than Three Conductors in Raceway or Cable
(Based on Room Temperature of 30° C. 86° F.)
Size AWG MCM
Synthetic Types TW-T
Type RU
Rubber Types R-RW
Rubber Type RH
Paper
Synthetic Type TA
Asbestos Var-Cam Type AVB
Var-Cam Type V
Asbestos Var-Cam Type AVA
Impregnated Asbestos Type AI 14-9 Type AIA
Asbestos Type A 14-9 Type AA
14 15 15 25 30 30 30
12 20 20 30 35 40 35
10 30 30 40 45 50 55
8 40 45 50 60 65 70
6 55 65 70 80 85 95
4 70 85 90 105 115 120
3 80 100 105 120 130 145
2 95 115 120 135 145 160
1 110 130 140 160 170 190
0 125 150 155 190 200 225
00 145 175 185 215 230 250
000 165 200 210 245 265 285
0000 195 230 235 275 310 340
250 215 255 270 315 335 ....
300 240 285 300 345 380 ....
350 260 310 325 390 420 ....
400 280 335 360 420 450 ....
500 320 380 405 470 500 ....
600 355 420 455 525 545 ....
700 385 460 490 560 600 ....
750 400 475 500 580 620 ....
800 410 490 515 600 640 ....
900 432 520 555 ....
1,000 455 545 585 680 730 ....
1,250 495 590 645 785 ....
1,500 520 625 700 ....
1,750 545 650 735 ....
2,000 560 665 775 ....
Above Table gives current-carrying capacities for not more than three conductors in a raceway. If the raceway contains from 4 to 6 conductors, the values in the table are reduced to 80%. If the raceway contains from 7 to 9 conductors, the values in the table are reduced to 70%.
[8]

ANACONDA **ANACONDA WIRE & CABLE COMPANY**

46510

CONSTRUCTION CONTROL

Reaction to Veteran's Housing Order No. 1 runs from complete indifference to near panic. Neither extreme is justified. A relatively few men have the power to control a vast complex industry that accounts for over ten percent of our normal economy. Such authority, unparalleled in peace time, needs the keenest vigilance from the industry and the public. This is not the time for complacency.

On the other hand, shut-off of all commercial and industrial construction, although possible under the order, since the authority is there, is not even a remote threat. Projects already under way can go ahead as speedily as materials supply will allow. Essential projects which can be started without interfering with housing will, in all probability, receive quick approval. At the moment the machinery is slow, unwieldy and not too consistent. That will change as policy clears and experience accumulates. There is no basis for panic cutback in plans, sales or business objectives.

Electrical construction, installation and maintenance as an industry is set up to handle something over a billion dollar annual market. Electrical work on the Wyatt housing objectives runs about 75 millions during the next twelve months. If it were double that, the electrical industry ought to be able to swing its share of the job easily. The chances that wiring will hold up any home building are slim indeed. That is, unless we are so loaded with other work that we are bogged down beyond capacity.

Basically, the housing order is designed to prevent that. It is intended to keep housing materials from being drawn off into commercial and industrial construction. The problem isn't so serious in electrical work, not because there is any abundance, but because other types of building materials are much more critical.

Some jobs, particularly those unrelated to new construction, ought to be immediately excluded from the order. Rewiring and lighting modernization, for example, use little of the needed housing materials, yet represent a very important industry job of permanent economic benefit to the country. How soon we can expect such relaxations will depend on how quickly operation of the order gets down to practical and realistic policies.

We don't think the controls are going to be popular or pleasant. We are not convinced that they are needed. But one sure way to get out from under is to build homes by the millions and build them quickly. Government has acted. Veterans Housing Order No. 1 is on the record. We can be certain that any failure to provide housing now will be blamed squarely upon the construction industry.

Electrical materials need not be listed as critical. It is up to the electrical industry to see to it that they are produced in abundance and channelled to house wiring. And we don't mean over the dime store counter. Electrical contractors can see to it that no local housing work wants for labor or materials. It may mean stripping men and materials from other work from time to time, but it's worth doing. With a clean record of speeding housing, and the statistics to show that our industry can easily handle the needed electrical work, there is no reason why we cannot soon demand and receive complete exclusion from construction controls.

Wm. F. Stuart

Power Apparatus

GraybaR distributes G-E motors, controls — switchgear — other apparatus — and offers specialized, local service

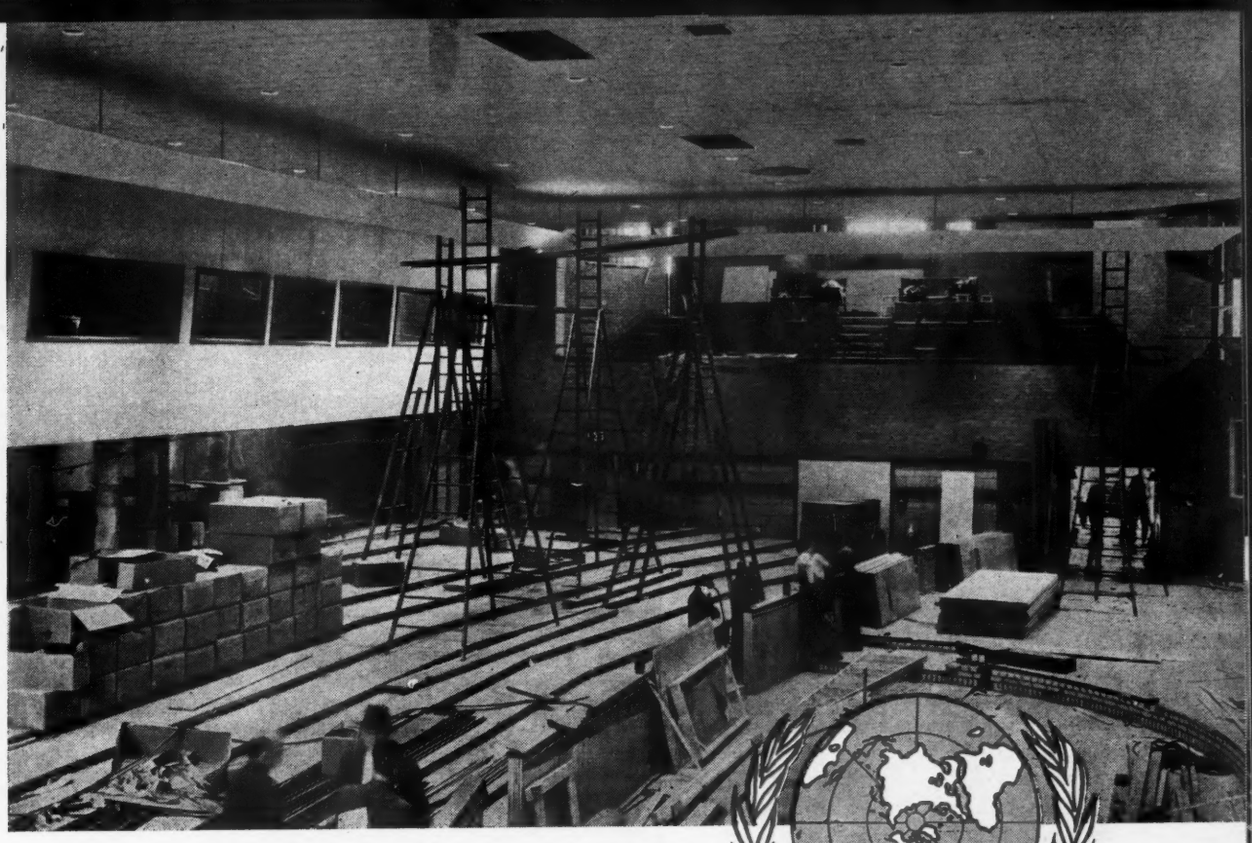
Whether it's 100 hp. or 1/100 hp. that's needed, Graybar is your best source for the proper motor, control units, and everything else the installation requires. Electrical contractors everywhere obtain power apparatus via Graybar, because: (1) We distribute G-E motors and motor controls — and transformers. switchgear, circuit breakers, capacitors, etc. (2) The near-by Graybar Power Apparatus Specialist is always ready to help in selecting and applying the best units for each job. (3) Our nationwide warehousing system speeds delivery.

Right now you can get immediate delivery of many electrical items from Graybar. As production of scarce items increases, you'll find us ready to help you meet *all* your customers' needs for power apparatus, wiring, lighting, ventilation, and communication. *Graybar Electric Company. Executive offices: Graybar Building, New York 17, N. Y.* 4639

IN OVER 90 PRINCIPAL CITIES

ADEQUATE WIRING THE KEY TO THE HOME OF TOMORROW

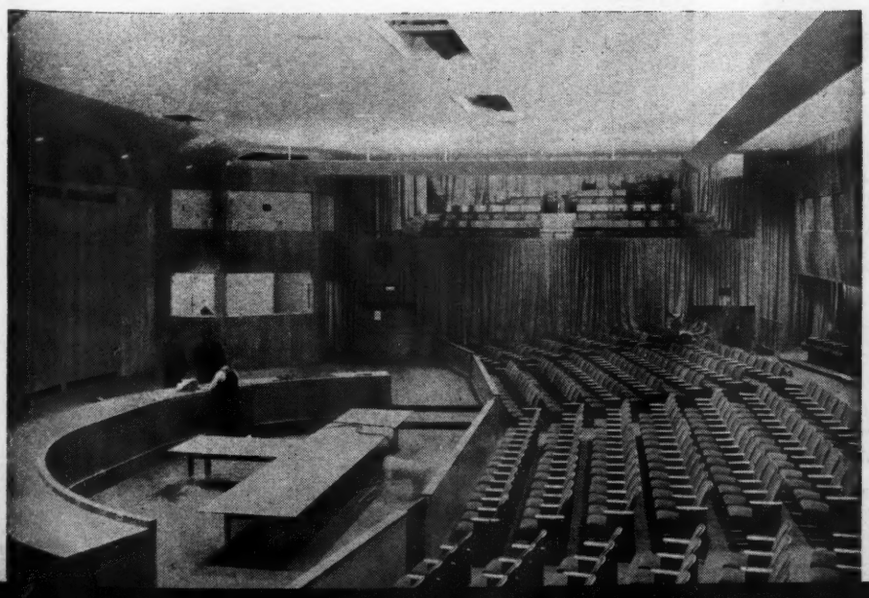
Everything for Electrical Contractors via GraybaR



Wiring for WORLD SECURITY

9000 man-hours of electrical work in 15 days set the stage for history-making United Nations conference.

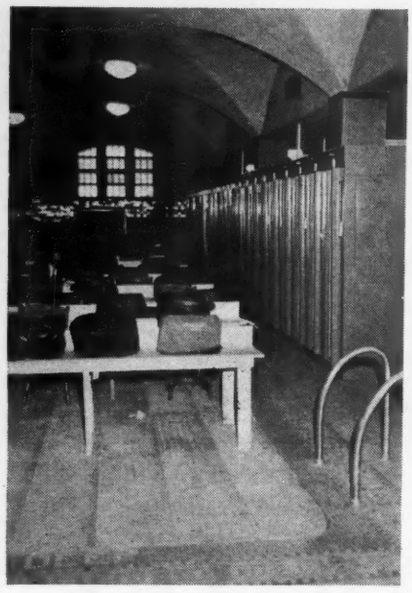
By Hugh P. Scott



TRANSLATED into the languages of all major nations, the current debates and decisions of the United Nations Security Council are making newspaper headlines and radio flash news items around the civilized world. Through the eyes of television, the movie and still camera; through the ears of radio, sound discs and recording tapes; through the interpretive analysis of commentators, the press and writers of world events; universal attention is

Picture taken of Council Chamber two days prior to first session shows mahogany plywood wall behind dais, trough for fluorescent lamps, recessed flood and down lights, State Department observation booth and wall drapes. Construction picture at top of page, taken eight days earlier, shows suspended radio booths, east Press balcony, brick foundation for curved Council table and terraced steps for auditorium seats.

A section of the telephone exchange which handled the heavy traffic of the Press and Delegates. Long rows of telephone booths stretch along side of Press room located over former swimming pool. Handrails in lower right indicate edge of pool before I-beam framework and pre-cast concrete slabs were placed at scupper level.



focussed on the U. N. Council Chambers with interim headquarters located in the gymnasium of New York City's Hunter College.

Behind the smooth flow of communications and the records on film and television screen, the dignity and comfort of the Council chamber is the experience and ingenuity of Electrical Contractor B. Eichwald and hardworking shifts of highly skilled electricians, who set up the intricate system of wiring in 15 round-the-clock days.

The month of March had already made its bow when the Hunter College gym was definitely leased as the temporary U. N. site and, with the opening session slated for March 23rd, the time element demanded that work be carried forward as quickly as possible. Formal submission of specifications, plans and competitive bids were waived in favor of immediate time-and-material arrangements with firms of established ability. Completion on time was possible only through close cooperation between the chosen firms, who justified the confidence placed in them, and the union labor groups. The architectural details originated with Voorhees, Walker, Foley and Smith; the builder was Robert Glenn Incorporated and the electrical contracting assignment was awarded to B. Eichwald and Company, all firms having offices in New York City. B. Eichwald, Jr., a Rensselaer graduate E. E. and wartime installation engineer for radio, radar and sonar, served as resident electrical engineer, remaining constantly on the job during the 15 transitional days of the installation period.

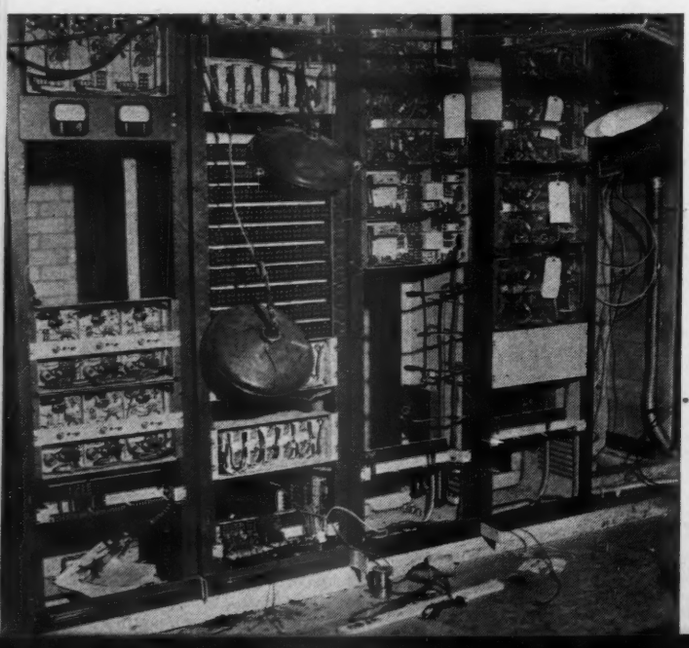
All electrical work with the exception of telephone service was installed by Local 3, IBEW men. Two 12-hour shifts rotated at noon and midnight under the direction of a general foreman, two sub-foremen for each shift and an audio foreman for that phase of the work. The number of men per shift varied as the work progressed, but approximately 9,000 man-hours were required for the electrical work during the two-week pre-convention span. Jurisdictional disputes were settled promptly without work stoppage, fulfilling a pledge that "the birthplace for Peace would not become a battle ground for Labor."

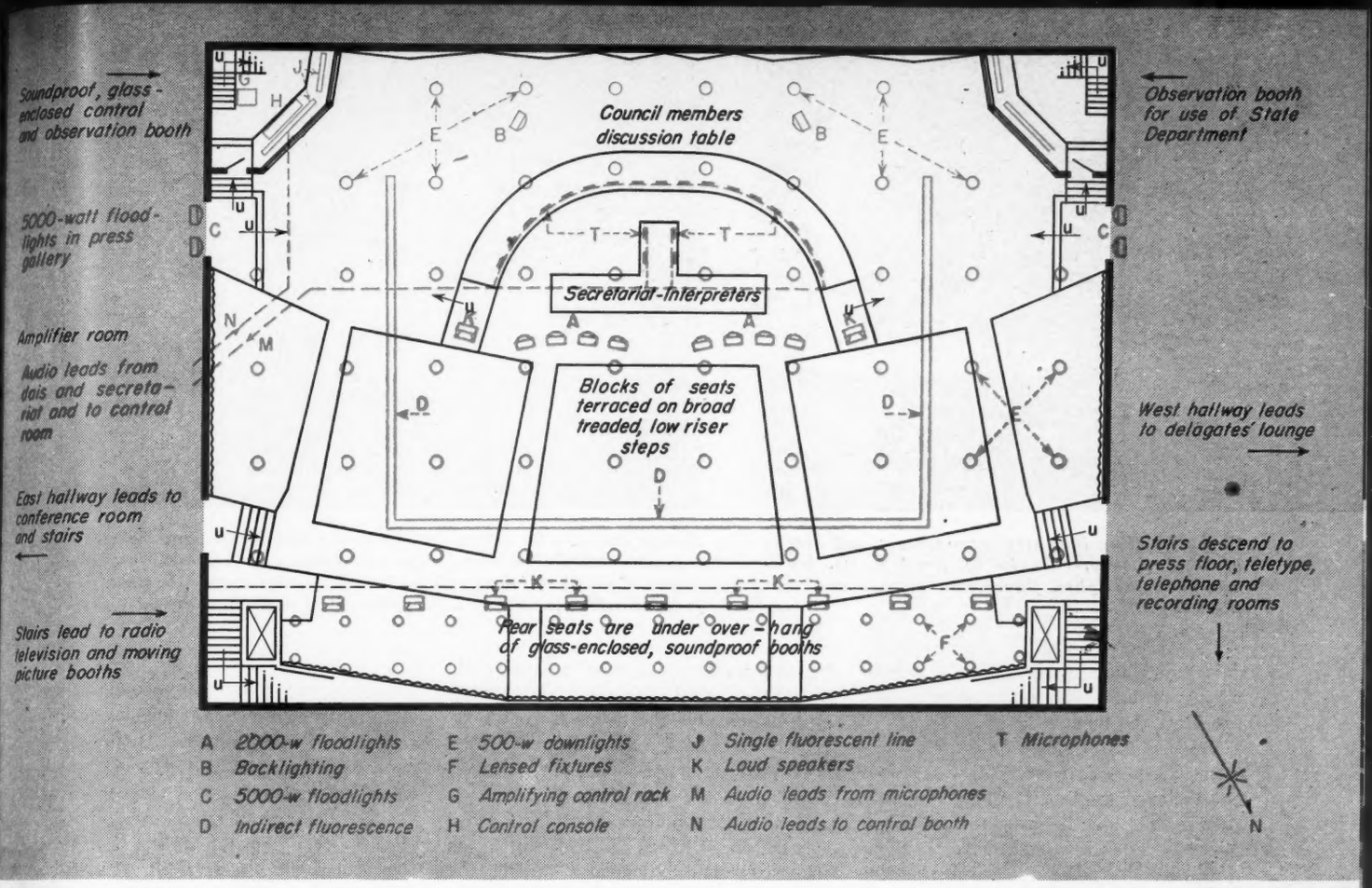
Physical Changes

Structural and decorative changes should be briefed in order to visualize major electrical problems and solutions.

The speed of conversion created both enthusiastic approval and wonder by all who followed the installation and construction work. The 7000 square-foot basketball court became a massive chamber where the members of the council sat in green upholstered chairs behind a curved, mahogany discussion table placed on a raised dais centrally located against the south wall. Rising tiers of broad-treaded, low-riser steps, ascending before the dais, were constructed to hold 554 adjustable-back, tan-upholstered seats for the few fortunate ones securing official permission to attend the sessions. Under the direction of Edward Content, WOR's acoustics consultant, a cream-colored acoustical ceiling was suspended at a height of 20 feet to hide overhead girders. Athletic equipment vanished while the south wall was paneled with serrated mahogany and the remaining walls draped with maroon and fawn fireproofed sailcloth. Dun heather carpeting covered all flooring and terraces. End balconies became press galleries. Ten glass-fronted, soundproofed radio booths and two rooms for television and camera were suspended

Intricate Public Address racks were completely wired on the job.




Soundproof, glass-enclosed control and observation booth
5000-watt floodlights in press gallery
Amplifier room
Audio leads from dais and secretariat and to control room
East hallway leads to conference room and stairs
Stairs lead to radio television and moving picture booths
Observation booth for use of State Department
West hallway leads to delegates' lounge
Stairs descend to press floor, teletype, telephone and recording rooms
Council members discussion table
Secretariat-Interpreters
Blocks of seats terraced on broad treaded, low riser steps
Rear seats are under over-hang of glass-enclosed, soundproof booths
A 2000-w floodlights
B Backlighting
C 5000-w floodlights
D Indirect fluorescence
E 500-w downlights
F Lensed fixtures
G Amplifying control rack
H Control console
J Single fluorescent line
K Loud speakers
M Audio leads from microphones
N Audio leads to control booth
T Microphones
N

Floor plan of United Nations Security Council Chamber. Types and locations of general and special purpose lighting units are indicated. Microphones and public address speaker assemblies are also diagrammed.

over the rear tiers of seats and similar observation and control booths also were constructed in the southeast and southwest corners. The finished chamber, impressively decorated and furnished, befitted the dignity of the Security Council. Rich without being ornate, plain without being barren, scientifically modern without being sensationally futuristic and solemn without being oppressive, it was a fitting setting for quiet and earnest decision. Flags, flowers and pictures were absent. Only one focal point existed in the huge room—the curved table behind which the eleven delegates, the Secretary General and Assistant Secretary General, and guest participants sat in discussion with the probable fate of Tomorrow at stake.

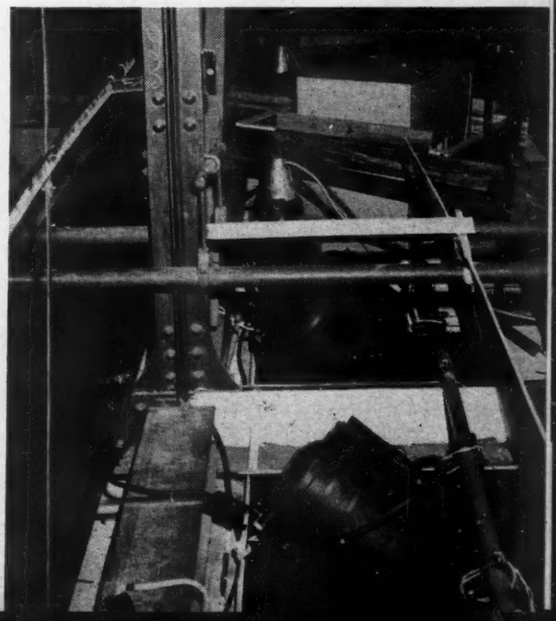
The electrical installation story can be segmented into three main divisions; wiring, lighting and audio. It can be sub-divided further into areas of application; the Council Chamber, Conference and Press Rooms, Lounge, Recording Room and Telephone areas.

Due to the hung ceiling, drapes, partitions and the definite location of booths, most of the original electrical outlets were blanked off and the originally-installed 44 circuits diverted for re-designed purposes. Excess capacity was fortunately available through the main distribution board of the gym building and four 300 MCM feeders were taken from the main service panel and run in 3-inch conduit across the sub-basement ceiling and up into the amplification room adjacent to the control booth.

The first of several electrical installation problems arose while routing this feeder. One of the clauses in the Hunter College-U. N. lease specified that no major structural changes were to be made during construction so that, at the termination of the leased period the gymnasium could be reconverted to its intended purposes without the necessity of relocating, refinishing or repairing walls and flooring. In accordance with this clause, tile and hardwood surfaces could not be broken or cut, so that on coming to such a wall, it was necessary to detour into a neighboring room or climb to a different level before returning to the planned line. Planning runs frequently called for the generalship of a quarterback and, due to its many changes of direction and elevation, the feeder to the amplification room was nicknamed "the corkscrew."

In the amplifying room an additional 36-circuit panel with four 30-amp. and four 60-amp. cutouts was located for general power and light although, due to the possibility of ballast hum and audio interference, none of the circuits in this room were used to supply fluorescent hook-ups. Three of the cutouts on the 36-circuit panel supplied current to one 12, one 8 and one 4-circuit subpanel. The 8 and 4-circuit panels supplied the floodlights which were trained on the

Catwalks above hanging acoustical ceiling permit access to banks of dimmer-controlled 2000-watt floodlights, 500-watt downlights and specially constructed high and low level Public Address speakers.



View of ceiling indicates arrangement and details of loud speakers, banks of flood lights, background cross-lights, fluorescent trough and ventilation grills.

Occupants of seats at rear of Council Chamber receive light from recessed lensed 100-watt lamps and hear speeches and announcements through loud speakers located under radio booths. Fireproofed sailcloth drapes hide gymnasium walls.

dais and council table and the second wiring problem was encountered while installing the floods.

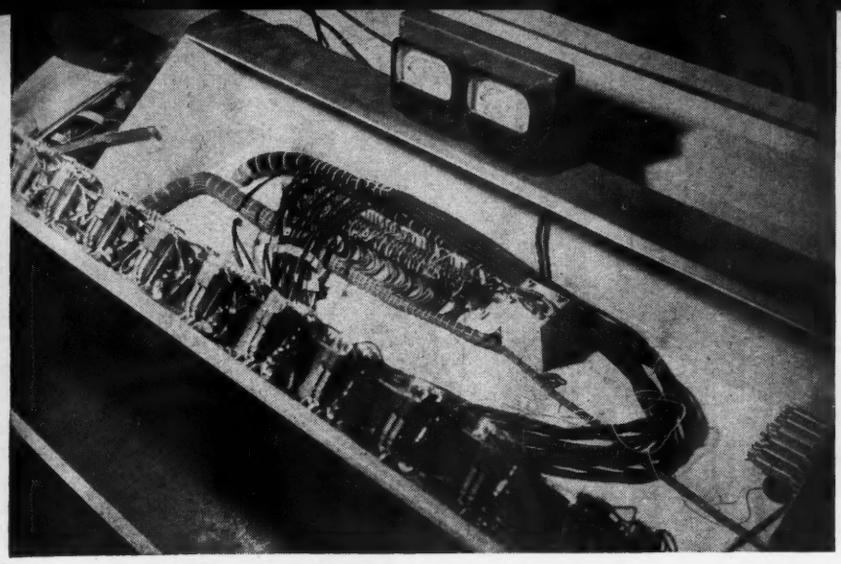
Television and movie camera requirements dictated that six 2000-watt floods be employed to furnish ample illumination for filming the proceedings. Four No. 4 wires were used and the installation was completed by connecting the lights in groups of two between the neutral and each of the three phase legs. On completion, light readings indicated that the six lights should be augmented by an additional four and the floods were regrouped into a 3-3-4 separation, placing loads of 6, 6 and 8 kw. across the three legs. Still another request specified that four 5000-watt floods be added but, due to phasing and capacity limitations, the No. 4's were inadequate. Four No. 1/0s were installed and the lamps connected in a 1-1-2 sequence. Final testing of this circuit was completed at 1:00 A.M. the morning of the 23rd and the first meeting convened at 3:00 P.M. the same day. Under the arranged operating schedule the two sizes of floodlights were used separately; the four 5000-watt lights flooding the council chamber before and after the meetings and the ten dimmer-controlled, more evenly spaced banks of 2000-watt lights focussed on the delegates during the actual transaction of business and discussion. Two of the 5000-watt lights were operated from each of the two Press Balconies located at either end of the chamber. The 2000-watt lights were recessed in the hanging ceiling grouped in two banks of four, above and in front of the council table, with the two remaining lights placed slightly behind and at the ends of the curved desk for proper backlighting and photographic fill-in.

Although on first thought it appeared that detours and rewiring delayed ultimate completion and created economical disadvantages, the opposite conclusion came closer to the truth. In the Council Chamber and other public rooms, the motivating objects were effect, appearance and environment. Behind the scenes, the main objectives were speed, efficiency and safety. Above the suspended ceiling, flexible conduit was placed directly on top of the acoustical panels and run in straight lines from point to point. Below the built-up terracing on the main floor the same treatment was used. In the basement, emergency wires were hung from insulating cleats and run across the ceiling or along partitions to comply with last minute Press requirements.

The electrical layouts often changed direction but it was evident that it was more economical to by-pass and sidestep obstacles than to conform to geometrical runs, bury the wiring and bore through walls and beams. After the opening deadline was successfully met, the electrical work continued in the in-

Delegates' Lounge Room, tastefully decorated and furnished, was lighted by six special fixtures holding 500-watt silvered bowl lamps. Glass plates with polished aluminum edging diffused general light and shielded light source.

B. Eichwald, Jr., electrical resident engineer, checks the 36-circuit panel located in amplifying room.



Soundproofed, glass-enclosed control booth had unobstructed view of Council table, chamber and radio booths. Operator of control console selected microphone before members and interpreters. Wiring of console was performed by electricians on job.

terest of appearance as well as utility. The work was considered "temporary" in the sense that the original lease ran only to May 15th, major changes to the permanent structure were forbidden and conduit was readily accessible. It was definitely a "permanent" installation in the sense that it complied with all code regulations concerning installation, capacity and safety.

Council Chamber Lighting

Primary general illumination in the Council Chamber was furnished by 54-500 watt downlights, spaced on 10-foot centers in either direction and recessed 12-inches above the hanging ceiling. All ceiling lights were accessible by means of catwalks. The six shovel downlights behind the dais were placed on a 27-degree angle to the surface of the rear wall of serrated mahogany.

Secondary general illumination was furnished by continuous runs of totally indirect fluorescent lighting in shallow V-shaped fixtures of plywood suspended 2-feet from the hanging ceiling. Two 32-foot side light troughs were placed 20 feet in from the east and west limits of the chamber while, closing the U of fluorescents, a 60-foot trough along the north side was located 8 feet in front of the overhanging radio booths. Two rows of white fluorescent lamps were installed end to end with joints staggered to eliminate dark reflective spots. A total of 65 tubes were used in furnishing 20-watts of illumination per linear foot.

Beneath the overhang of the radio, television and moving picture booths, 30 recessed lensed fixtures with 100-watt lamps furnished light to the occupants of the four rear rows of seats. Two rows of light were spaced 5 feet apart with a 6-foot spacing between the units of each line.

The problem of installing floodlights has already introduced this highlighting source. Without the floods, the average illumination level was 35 footcandles.

The press galleries, located at either end of the chamber, were lighted by two 20-foot continuous rows of 40-watt white fluorescent lamps which, unlouvered and unshielded, were placed slightly above the edge of the hanging ceiling so that no bare lamps were visible from any point on the main floor of the chamber.

Single rows of 40-watt white fluorescents were installed on the inside and above the glass line of control, observation, radio, television and camera booths. The total connected light load in this 7000 square-foot area was over 75 kw.

Audio Provision

All speeches and announcements carried on the audio circuits could only originate at one of the 23 microphones grouped in the center of the chamber. Microphones were located in front of the 17 seats at the council tables; four more were located at the T-shaped Secretariat table where the official interpretations of all speeches were translated into English and French, and two were on movable stands with 25-foot extension cords to permit their being carried to visiting dignitaries. The microphone leads were carried below the flooring to the amplifying room and from there to the control booth in a series of 2-inch conduits.

All of the intricate wiring of the Public Address racks and the control console was installed on the job.

With unobstructed views of the dais and chamber, operators in the control booth regulated the selection of microphone and the volume level going to two specially constructed high and low level units in the ceiling over the Secretariat, nine speakers under the radio booths, ten cones in the press galleries, twelve audio-outlets in the radio and television booths, four speakers in the observation booths and numerous units in other rooms and areas of the gymnasium. Audio leads were carried through an extensive system of 2 by 4-inch wooden troughs beneath the flooring and above the hung ceiling.

The control booth could cut off any or all speakers and could break all audio leads except six pairs of uncontrolled leads going to the basement sanctum where the Army Signal Corps, under the direction of Major R. Vincent, recorded all words spoken during every session. Major Vincent, also in charge of sound and recording arrangements at both the Nuremberg trials and the San Francisco Conference, stated that the complexity of the Security Council sound equipment surpassed both former

[Continued on page 115]

NISA MEETS in TAMPA

Electrical motor shop executives hold first postwar convention — discuss management, labor, sales, and methods during three day meeting.

R. B. Turner, Johnson-Turner Elec. Repair & Eng'g. Co. Ltd., Windsor, Ont.

R. E. Ward, Electric Motor and Repair Co., Raleigh, N. C.

THE National Industrial Service Association, Inc., held its first annual Convention since the beginning of the war in Tampa, Florida, April 8-10. Over 325 of its 705 members in the United States, Canada, Hawaii and Puerto Rico registered for the three-day affair. Total registration, including members' wives, reached near the 500 mark. J. Arthur Turner, of Tampa, past president of NISA, was Convention host and chairman.

A total of 26 session papers were presented by NISA members in the three-day meeting. In addition, the program included addresses of welcome, a business session, cocktail party and banquet, an address by Dr. Ellwood C. Nance, president, University of Tampa, and a closing illustrated lecture by Dr. J. T. Wilson, Physicist, Allis-Chalmers Manufacturing Company. The subject of Dr. Wilson's talk was, "Significance of Atomic Energy". This last lecture was also well attended by managers of local phosphate mines and other leaders of industry.

The Convention was opened in the huge Palm Room of Tampa's Terrace Hotel by Convention Chairman Turner. He introduced Rev. Richard J. Broyles, pastor, Hyde Park Methodist Church, for invocation, and Truman Green, Tampa Morning Tribune, who welcomed NISA to Tampa in a ten minute address.

NISA president Wm. H. Braunlich, of Braunlich-Roessle Company, Pittsburgh, Pa., introduced by Chairman Turner, gave a short talk, during which he welcomed the membership to the Convention, and thanked the Florida chapter for its invitation to Tampa, and for the excellent program which had been planned. He complimented the entire membership for their spirit of cooperation in exchanging helpful information, as exemplified by the subjects slated for discussion by NISA members. It was explained that the program had been planned particularly for new members, those joining NISA since its last convention previous to the war. Older members hearing subjects discussed for the second time were advised to consider them as refreshers.

F. W. Willey, active NISA member from Willey-Wray Electric Co., Cincinnati, keynoted the Convention in a short address, and then served as Sessions program chairman. He pointed out that NISA membership has doubled in the last five years, but cautioned, "Our own effort must be applied in our own industry" in order to increase productivity per capita. The Convention program was planned around improved management, increased sales and improved methods, he stated. Each subject was carefully selected to fit into this program, and each speaker for each subject was selected because of his knowledge of that subject, he said.

Approximately 15 exhibitors, consisting of manufacturers and suppliers of repair shop equipment, parts, supplies, etc., were each given three minutes to discuss the outstanding features of their respective exhibits. One period of the program was also set aside for visits to these exhibits.

Six papers were given by NISA members under the Management session of the program. Carl H. Brunner, West Virginia Armature Co., Bluefield, W. Va., was session chairman for this part of the program.

Job Classifications and Merit Ratings. This subject was discussed by F. W. Willey, member of the NISA Executive Committee. He presented a method of drawing specifications for both the job and the worker, based on the fundamental principle of paying according to actual value. The method was based on a scientific means of determining that value. Under his method, 16 factors were considered. Several of these factors were assigned points based on relative values, totalling (arbitrarily) 3000 points each. Each factor was broken down into grades from 0 to 10. Typical job descriptions were reviewed, along with their gradations. Job evaluation forms for listing job *point* values, as well as a conversion chart, for listing job *pay* rates were also discussed. The Committee on Job Classifications will complete evaluation of the 16 job factors and provide the 0 to 10 grading of each, Mr. Willey stated, and also furnish a number of typical job descriptions. Using these as a guide, any executive will be able to make up job description for all jobs in his plant.

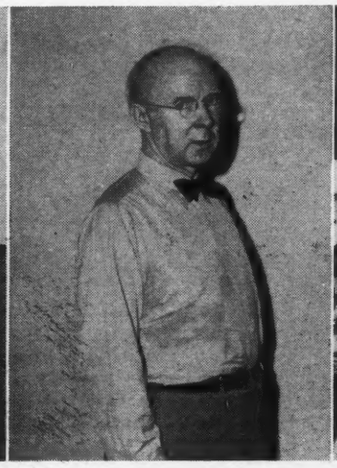
Compensation of Superintendents and Foremen and their Duties. This subject was presented to the Convention by Chas. J. Cannon, A. H. Nimmo Electric Co., of Detroit. Superintendents receive maximum pay among shop personnel, since their duties include maximum responsibility, such as hiring and placing employees, scheduling work, handling engineering problems, etc., Mr. Cannon said. Foremen act as assistants to superintendents, and hence are next in line in rate of pay. It was pointed out that rates will vary in different parts of the country. Mr. Cannon stated that in the Detroit area superintendents' pay ranges upwards from $125.00 per week while No. 1 foremen receive $75.00 to $100.00 per week. He further quoted rates of pay for workmen, such as winders and servicemen at $1.68½ per hour, assemblers and machinists at $1.53½ per hour, and helpers at $1.00 to $1.30. At Mr. Cannon's suggestion, other members from various sections of the country quoted prevailing wage rates in their respective areas. Rates of pay generally were lower in most other areas, but above Union rates in most cases, members stated.

H. E. Grant, NISA secretary, Tennessee Electric Motor Service, Nashville, Tenn., discussed *Group Incentive Plans,* presenting a summary of a survey made among other members who use such plans. Such plans create within the

William H. Braunlich, Braunlich-Roessle Co., Pittsburgh, Pa.

J. M. Pilmer, Electrical Engr. and Const. Co., Des Moines, Iowa.

M. G. Miller, Tennessee Electric Motor Service, Knoxville, Tenn.

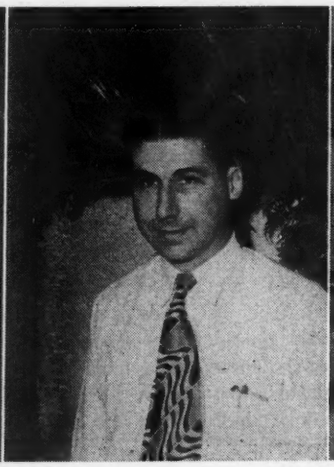


J. W. Overstreet, National Electric Coil Co., Columbus, Ohio.

F. J. Willey, Willey-Wray Electric Co., Cincinnati, Ohio.

J. Arthur Turner, Tampa Armature Works, Tampa, Fla.

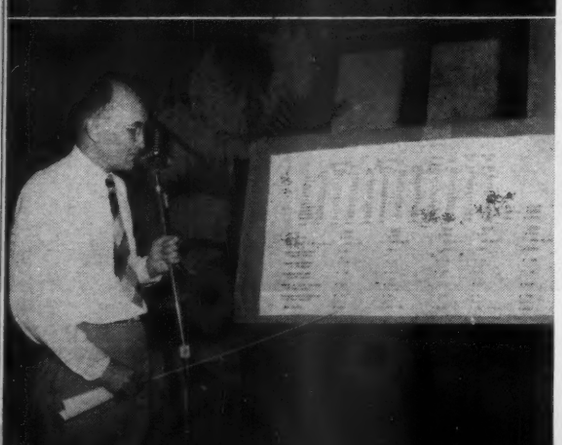
Miss Iyla Tracy, A. S. Tracy, Concord, N. H.



Laurence L. Alldritt, Alldritt Electric Motor Co., Miami, Fla.

W. W. Hanks, Southern Electric Service Co., Charlotte, N. C.

Carl H. Brunner, West Virginia Armature Co., Bluefield, W. Va.



TOP TO BOTTOM (1)—Ernie Steppan, Insulation and Wires, Inc., St. Louis; Paul E. Stouffer, Essex Wire Corp., Fort Wayne, Ind.; "Chet" Brigham, Insulation and Wires, Inc., Boston; George H. Brown, Insulation and Wires, Inc., St. Louis. (2) New Officers; Sec'y., H. E. Grant, Tennessee Elec. Motor Service, Nashville; Treas., S. F. High, Sullivan Elec. Co., Cincinnati, O.; V. Pres., R. E. Ward, Elec. Motor and Repair Co., Raleigh, N. C.; Pres., R. B. Turner, Johnson-Turner Elec. Repair and Eng'g. Co., Windsor, Ont. (3) S. V. Steffner, Chattanooga Armature Wks., Chattanooga; R. E. S. Swam, R. E. S. Swam Elec. Co., Hanover, Pa.; S. T. Stewart, New Orleans. (4) J. J. M. Smith, Stearns, Perry and Smith Co., Boston; G. W. Williams, Superior Elec. Service, Springfield, Mass.; Fred S. Ferris, Northeastern Elec. Co., Boston; John J. Reddington, J. J. Reddington Elec. Service Co., Boston; Alfred L. Brown, Alfred L. Brown Associates, Inc., Worcester, Mass.; Wm. Downes, J. J. Reddington Elec. Service Co., Boston. (5) S. F. High, Sullivan Elec. Co., Cincinnati.

employees the incentive to perform at all times to the best of their ability and by such effort be compensated proportionately more than had they given a mediocre performance, Mr. Grant said.

Profit Sharing and Pension Plans were reviewed by R. B. Turner, NISA vice president, and member of Johnson-Turner Electric Repair and Engineering Company, Limited, Windsor, Ontario, Canada. Workers are entitled to share in profits, he stated, but should also share losses in like manner, should they occur. Where profit sharing plans are put into effect, they should apply on an equitable basis with all employees, he said. Pension plans are also important in the electric repair business, he stated, since workers with most other industries operate under pension plans.

Office Management and Methods were discussed by S. F. High, NISA treasurer, Sullivan Electric Company, Cincinnati, Ohio. He demonstrated time-saving methods in bookkeeping, used by his firm, saving up to 60 percent time in handling billings. By means of a large chart, he also presented a "cost analysis", showing breakdown of costs in various shop departments. Use of this cost analysis procedure will show just where any losses occur, by department, and whether due to material costs, labor costs, or otherwise, Mr. High demonstrated.

R. E. Ward, Electric Motor and Repair Co. of Raleigh, N. C., addressed the group on *Training and Rehabilitation of Veterans* in the electrical repair industry. He outlined how his company has worked with the Veterans Administration in an Apprentice Training program. He has 16 veterans in this program, each obtaining from 48 to 60 months training in his shop, he said. Class instruction is provided by the Electrical Engineering department of the University of North Carolina, Raleigh, N. C., using the NISA National Certification Board's Training course, "Shop Fundamentals", as a basis for this instruction, he pointed out. Veteran apprentices are paid by Mr. Ward's company, with supplemental pay from the Veterans Administration, he stated, and as increases in pay are granted by the company, VA subsistence allowance is decreased so that the veteran's pay does not exceed a journeyman's wage, as agreed upon by VA.

Sales Session

J. M. Pilmer, Electrical Engineering and Construction Co., Des Moines, Iowa, presided at the Sales Session, consisting of six addresses, all by NISA members.

Selection and Training of Salesmen. "You must start now to select and train your future salesmen, or lose your place in industry", Lynn F. Hummel, The Glow Electric Company, Cincinnati, told the group, pointing out that sooner or later it will again be necessary to sell services rather than try to meet customers' demands, as has been necessary for the past three or four years.

The number of salesmen needed to cover a territory was analyzed from an economic standpoint. This problem should be placed on a dollars and cents basis, Mr. Hummel said. He further discussed the type, qualifications, personality, education and other factors and traits of prospective salesmen, sources, and training. "Selling is based on what you can do for your customer and proof of why you can do it", he stated. It is therefore necessary to give the salesman a complete training to acquaint him with his products, their limitations, possibilities, and what can be done with them, he said.

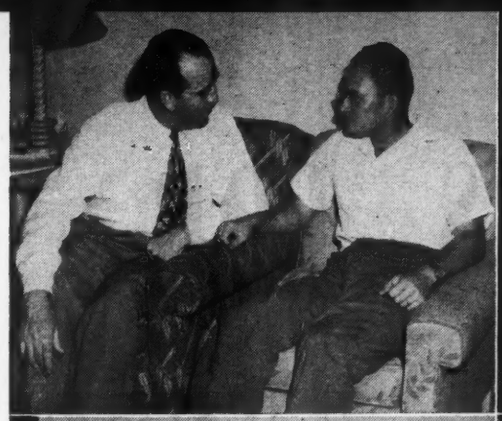
Salesman's Compensation. F. R. Hannon, Hannon Electric Company, Canton, Ohio, pointed out that if anticipated annual volume is less than $50,000, a full-time salesman cannot be justified, especially on a 15 percent net margin which some manufacturers and distributors contend is adequate. Small operators require a 20 percent margin, he stated. Senior salesmen should receive $45.00 per week, and junior salesmen $30.00 per week, plus a 20 percent commission of net margin on all sales over $300.00 per week, he pointed out, with

transportation, expenses and entertainment paid by the firm. The commission method will require extra bookkeeping, but will enable the owner to correctly appraise the salesman's efforts, he said.

O. P. A. Regulations and the Robinson Patman Act. Wm. J. Wheeler, The Maintenance Company, New York City, presented a review of O. P. A. Maximum Price Regulations, with particular emphasis on MPR 581, in the language of a layman, cautioning that all official orders and regulations should be studied carefully by all to whom these orders apply. Service and repair work is still subject to price controls, he said, even though there now exists excess capacity and competition in the industry. Prices of new and rebuilt machinery (also subject to price ceilings) in themselves provide effective price ceilings on repair and service work. The Association has requested suspension of MPR 581 as it relates to electrical repair work, he stated, since such work is not a cost of living item, the few necessary upward price adjustments for the repair work and services would not affect prices, rent ceilings or cost to the United States.

Executive Order 9697, issued by the President, Feb. 14, 1946, *permits* O. P. A. to approve increased price ceilings to adjust for certain approved increases

(Continued on page 179)



FIRST COLUMN TOP TO BOTTOM
(1) L. D. Kennedy, Sec'y. Greater City Electrical Contractor's Assn., N. Y. C.; J. Aruthur Turner, Jr., Tampa Armature Wks., Tampa; (2) A. H. Barrere, Jr., Russell Elec. Co., Inc., Mobile, Ala.; M. G. Miller, Tennessee Elec. Motor Service Co., Knoxville; J. L. Hudson, Hudson Refrigerator Motor Service, Jacksonville, Fla. (3) Ray F. Hornbeck, T. H. Green Elec. Co., Inc., Rochester, N. Y.; C. R. Durand, H. N. Crowder, Jr. Co., Allentown, Pa.; H. F. Janick, T. H. Green Elec. Co., Inc., Rochester, N. Y. (4) R. A. Reed and George Larsen, R. A. Reed Elec. Co., Los Angeles. (5) Dr. J. T. Wilson, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SECOND COLUMN TOP TO BOTTOM
(1) C. B. Kaska, Chicago Elec. Co., Chicago; Fred. B. Wipperman, Exec. Sec'y. National Industrial Service Assn., St. Louis. (2) E. G. Gossett, E. E. Gossett and Sons, Greenville, S. C.; Henry N. Beemster, Beemster Elec. Co., Green Bay, Wis.; H. W. Pedersen, Industrial Eng'g. Equip. Co., Davenport, (3) T. M. Russell, Russell Elec. Co., Inc., Mobile, Ala.; Garrett R. Lea, Lea Elec. Co., Chicago. (4) Alfred L. Brown, Alfred L. Brown Associates, Inc., Worcester, Mass.; Fred S. Ferris, Northeastern Elec. Co., Boston. (5) H. E. Grant, Tennessee Elec. Motor Service, Nashville; C. J. Cannon, A. H. Mimmo Elec. Co., Detroit.

HELPS FOR HOUSE WIRING

Adequate wiring promotion backs the contractor and sets the stage for the greatest residential wiring job of all time.

WHEN you talk *Adequate Wiring,* you are backed by the strongest support the electrical industry has ever put behind the contractor. By intensive education and promotion the principles and benefits of adequate wiring are working into every phase of home building, from financing to the owners A-W certificate. Sales helps in elaborate array are available. Every branch of the industry is actively supporting the program. Adequate Wiring means better business for contractors. It means better wiring and better electrical living for the public. And with an all-out housing program under way, an A-W certificate is sound, responsible assurance that the electrical job is up-to-date.

Adequate Wiring is headed up by the National Adequate Wiring Bureau, sponsored by the National Electrical Contractors Association, National Electrical Manufacturers Association, National Electrical Wholesalers Association, International Association of Electrical Leagues and the Edison Electric Institute. Its purpose is to "promote the installation of sufficient wiring to allow fullest enjoyment of electrical living." The N.A.W.B. handles national promotion, helps to set up local Adequate Wiring Bureaus and actively advises and serves local activities and local industry groups.

The spearhead of Adequate Wiring is the local Bureau where industry efforts are coordinated, certification standards set up and certificates issued.

Behind the local activity is the spade work of the N.A.W.B. Through a well organized educational and publicity program, the story of A-W is gaining recognition in many strategic areas:

1. Grapic evidence of the benefits of A-W are presented to national associations in the home building field. Builders are shown how A-W homes are *salable* homes.

FOR CONTRACTORS—Plan sheet, proposal, furniture cutouts, customer materials, window and truck decals.

2. Home financing and F.H.A. officials are kept informed on the appraisal value of A-W laying the ground work for greater cooperation with local Bureaus. Such recognition by financing groups of the better risk of an adequately wired home carries weight with home owners and builders alike.

3. Advice and technical counsel are given to prefabricators so that prefabs will be designed for modern electrical living and allow installation of modern wiring.

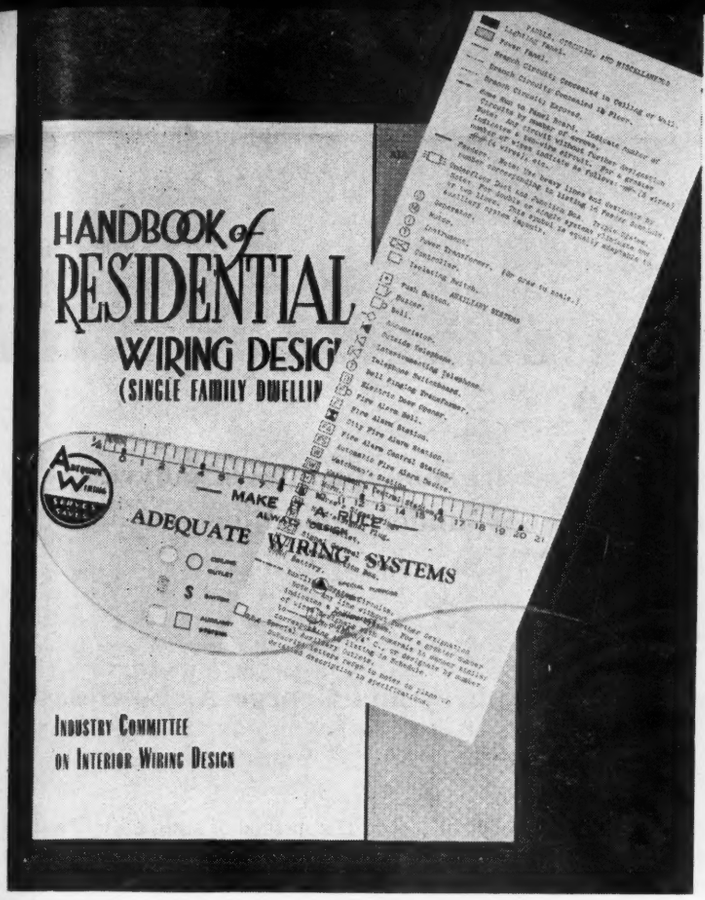
4. An educational program is available for educators and home economics leaders consisting of a series of teaching outlines and supplementary reference material stressing the importance of adequate wiring in efficient home management.

5. Lecture and demonstration helps, posters, pay envelope stuffers and other helpful materials are available for electrical industry employees telling the story of A-W and showing its importance to every phase of the industry.

6. Slides and lecture materials are available and constantly used for business clubs, women's organizations and similar groups emphasizing the role of wiring in modern living.

7. By providing editors and writers with accurate data, N.A.W.B. has helped in the preparation of numerous articles and stories in women's magazines, newspapers and other publications which inform the public about the advantages of modern wiring.

Helps for local A-W Bureaus include a wide range of material, some illustrated here. The complete array is listed in a catalog available from N.A.W.B. headquarters in New York. A plan of action gives sound counsel for using this powerful sales material in any community.

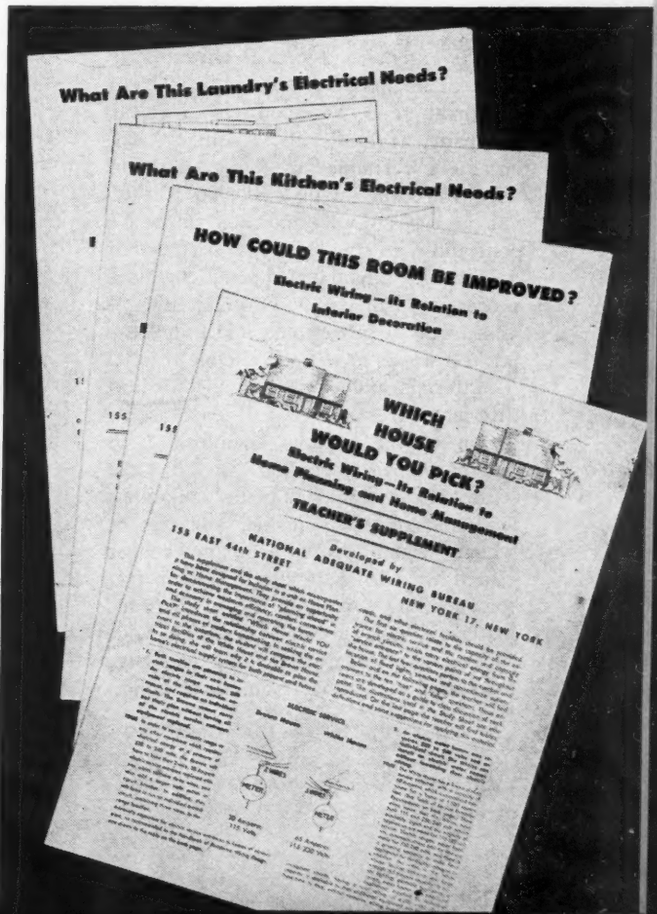


FOR ARCHITECTS—The Handbook of Residential Wiring Design, Standard Symbols and die cut symbol guide.

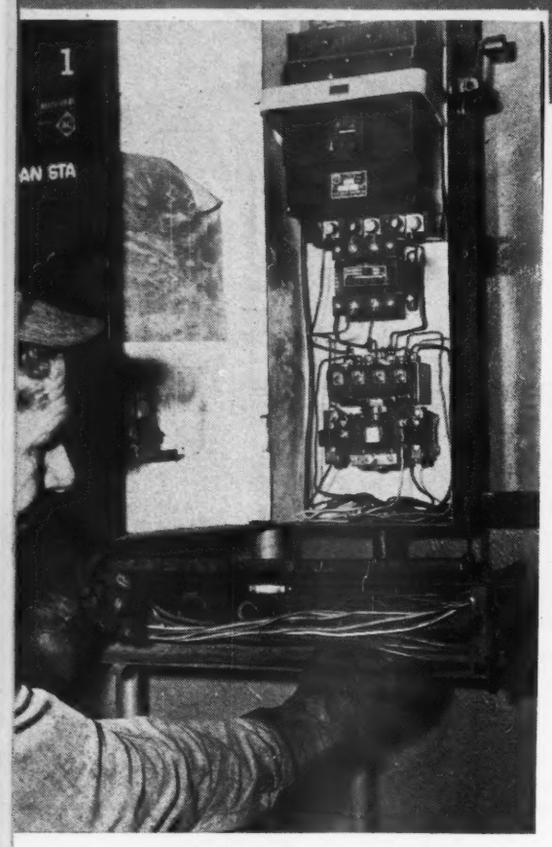
FOR BUILDERS—The Key to Saleable homes gives sales features of A-W, customer booklets explain the job.

FOR LOCAL BUREAUS—Certificates, record forms, customer materials, advertising layouts.

FOR TEACHERS—Outlines and supplementary materials for home economics courses.



"T" Can Take It



T wires in boiler room after four years keep colors in spite of steam and coal dust.

Rugged tests in service show qualities of polyvinyl chloride insulations under conditions encountered in chemical plants.

By Glenn W. Humphrey and George A. Fowles,
Electrical Engineers,
B. F. Goodrich Chemical Co.

THE extensive electrical wiring system in the Geon polyvinyl chloride plant of B. F. Goodrich Chemical Company, at Louisville, Kentucky, has become a veritable proving ground for wire and cable with 2,500,000 feet of various types of wire and cable subjected constantly to the various destructive conditions attendant upon chemical processing. Further, an Ohio River flood added a most unwelcome but enlightening test which produced valuable results.

Materials and equipment installed in this plant are exposed to the corrosive action of the various chemicals used and developed, including caustic soda, hydrochloric acid, chlorine, sulphuric acid and sodium chloride, any one of which would cause ordinary rubber coated wire to disintegrate. Other factors, making for short life in ill-suited materials, are present, such as wide ranges of temperature and excessive moisture, as distinct from flood conditions.

Simplicity of installation, speed of construction, and elimination as far as possible of shutdowns due to mechanical failure were other requirements dictating the choice of materials. The full capacity of this plant at the earliest possible moment was urgently needed to help meet the tremendous demands of the Army and Navy for polyvinyl chloride to insulate and jacket wire and cable.

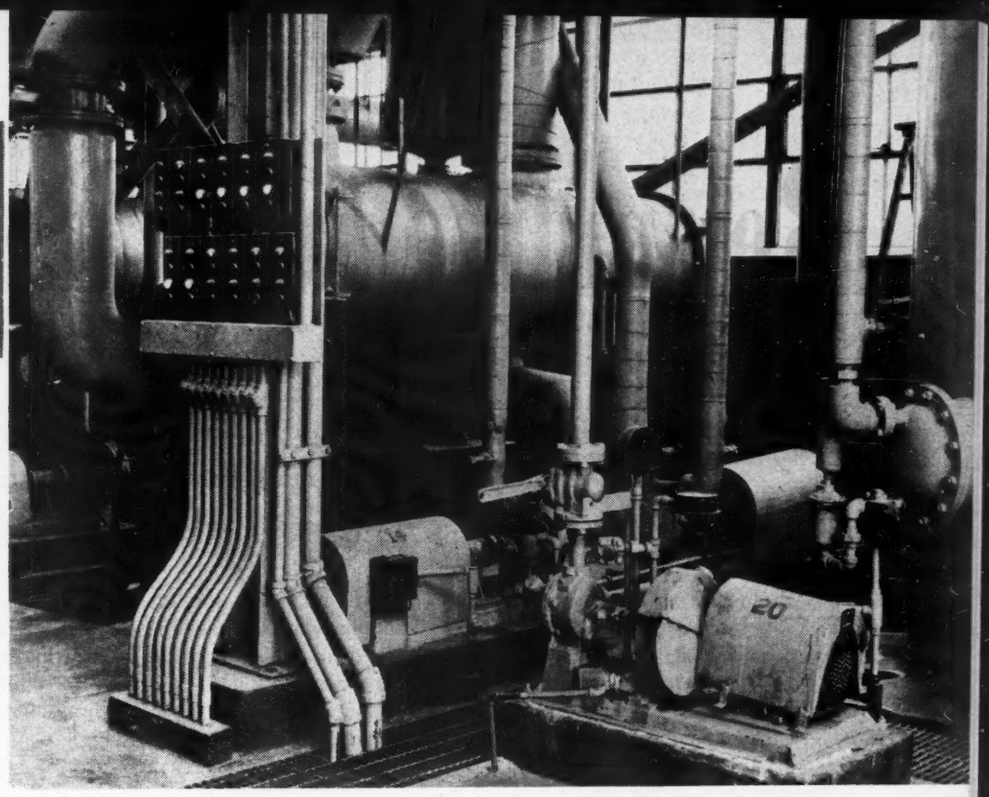
Especially important of all the construction materials were wire and cable, for the reason that there was a much greater footage here than required in the ordinary plant of comparable size and because of the difficulties encountered in certain areas in the replacing of wire. Greater than normal footage was needed due to the fact that all wiring in the many processing areas runs to remote control points, located at some distance from the fire-hazard sectors. For example, the 676 motors in the plant each require a run of wire averaging 200 feet per motor leading to a remote control. In addition, extensive instrumentation, to keep accurate control of all processing steps, adds to the total wiring required.

Replacing of wire under ordinary conditions is an expensive operation and includes not only the actual cost of the installation but the incalculable expense of the shutdown necessary to change the leads. At this plant it is doubly difficult and many more times expensive because of the great number of explosion-proof conduit fittings installed in all manufacturing locations. These fittings serve to sectionalize the conduit system and prevent the travel of explosive or inflammable gases through the electrical system. The method of sealing these fittings makes it impossible to free the wires passing through them, without cutting the fitting out of the line. Removal of the fitting permits removal of the wiring but, on replacing, the conduit must be rethreaded. Wherever a fitting is cut out, a union is added in order to reconnect the conduit and a new explosion-proof fitting installed. After all wires through the fitting are positioned, the sealing compound must then be poured into fitting. This procedure entails a lot of work and expense.

The logical choice of covering for the wire and cable was the very material to be later produced in the plant, polyvinyl chloride, for outstanding among its properties are unusual chemical inertness and resistance to corrosion, both all-important in this installation. For example, immersion for 55 days at room temperature in such materials as concentrated hydrochloric acid, 50 percent nitric acid, concentrated sulfuric acid, 30 percent chromic acid or 46 percent sodium hydroxide solutions, changes the weight of polyvinyl chloride compounds only from 1 to 6 percent.

To prove its resistance to moisture, polyvinyl chloride coated wire was continuously immersed in water for three years, but no appreciable change in electrical or physical properties was observed.

The thermal stability of polyvinyl chloride, wherein certain compounds will flex at temperatures as low as −75° F. and other compounds remain stable up to +175° F., would take care of the wide ranges of temperature present at this plant.



Motors and control in the Caustic Soda building are constantly exposed to condensate. Wire insulation stood up although the conduit disintegrated.

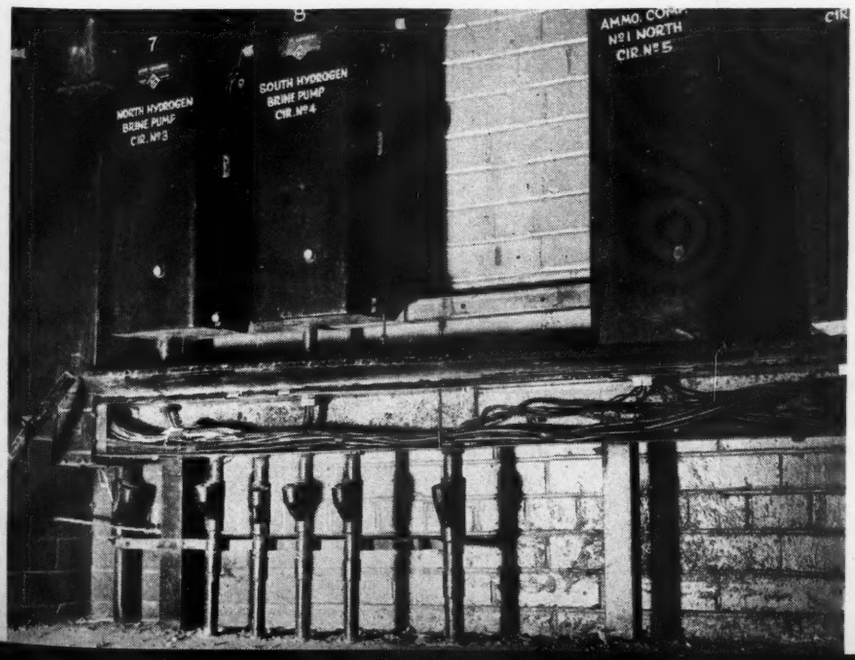
The polyvinyl chloride coated wire has a slick smooth finish which makes "pulling in" easy. The polyvinyl chloride coated wire, too, has the ability to strip readily from the conductor, facilitating splicing. These factors all combined to give the speed and ease of installation desired.

The "proving ground" angle, affording a comparison between polyvinyl chloride (PVC) coated wire and rubber coated wire, developed during construction when it became impossible to obtain sufficient polyvinyl chloride (PVC) coated wire to complete the job and some rubber coated wire and cable was installed. The Army and Navy both held top priority on the PVC wire, the Army taking it for Signal Corps assault wire with its high resistance to mildew, fungus and abrasion, and the Navy for shipboard wire and its flame proofness. Very little was left for lower priority use, so both types of wiring were used.

The greatest footage of wire installed here falls naturally into three gauges, No. 10, No. 12, and No. 14, with 2,250,000 feet in these three sizes in PVC wire. This is installed in conduits and ducts and in some cases exposed to the weather. Originally there was some rubber coated wiring in these sizes but this was entirely replaced after a year's service by PVC wire for the reason given later in the story. Control and secondary wiring is largely of No. 14 Awg wire.

At the time the plant was built, approximately 7,000 feet of wire in the larger gauges was required. All of this is coated with materials other than polyvinyl chloride for the reason that the armed forces were taking the entire output of vinyl-insulated wire in these gauges. However, two years later, it was possible to obtain PVC coated wire in No. 00 Awg for a very interesting application. In this case, 3,000 feet was required to deliver power to a 100 hp. 550 volt pump motor in a well house located in a field 1,000 feet from a source of power. The group of conductors were laid in a ditch three or four feet deep without the usual protective lead sheathing. Its only protection was sand placed around the conductors, with planking on top of the sand to warn anyone digging in that area, then the ditch filled with dirt. There is also a second installation of buried PVC coated wire, in this case, No. 14 Awg signal wire used on the 110 volt autocall system, connecting the office building and the plant, and buried in the ground. Here are two installations where trouble, due to the abrasive and chemical action of the earth and moisture, could ordinarily be expected in time but to date has not appeared.

In hydrochloric acid building old wiring was replaced by P.V.C. With sealing fittings wire must stand up because replacement is difficult and expensive.



The results at this "proving ground" for wire and cable have been most interesting. Before discussing results, however, it should be pointed out that all wiring here is operating near its top limit of voltage, namely 600 volts, in addition to its exposure to the many destructive conditions present which are constantly trying to tear it down. Instead of the usual 220 or 440 volts used in most plants, the Geon plant operates at 550 volts throughout.

Under these tough conditions, there have been *no* failures of PVC coated wiring.

The installation of PVC coated wire in the salt storage shed is particularly worthy of mention. Salt, one of the basic materials used in the manufacture of polyvinyl chloride, is required in large quantities. Accordingly, a shed, approx-

[Continued on page 184]

Rewinding and Reconnecting

The theory of rewinding and reconnecting induction motors, together with simple mathematics and illustrative examples.

IN the operation of induction motors, it is often required to make changes in the number of phases, the operating voltage, the frequency, and the speed for which the moter was designed. These changes may often be made by reconnecting or rewinding. The design characteristics of the motor and the requirements of the load usually determine whether a given motor will operate satisfactorily after it has been reconnected or rewound. Evidently, variety of changes or combination of changes may be met in practice. This article will deal with these changes by describing the theory involved with simple mathematics and illustrative examples.

Change In the Number of Phases

The most common of these changes is from single and two-phase to three-phase or vice versa. Reconnection of a motor, when possible, is often accompanied by loss in capacity and sacrifice in intended performance as regards torque, heating, power factor, and efficiency.

Single-phase to three-phase change.—In re-designing a single-phase induction motor for operation on a three-phase supply while keeping the frequency, the speed, and the magnetic density in the core constant, it is necessary to maintain the voltage per turn on three-phase the same as it was on single-phase. The problem consists, therefore, in calculating the average effectiveness of the single-phase winding in setting up magnetism and generating c.e.m.f., and laying out a three-phase winding each phase-winding of which is equivalent to the single-phase winding.

In calculating the average effectiveness of a winding, the distribution factor and the chord factor of each turn or coil has to be calculated. The distribution factor may be taken as 0.955 for three-phase and 0.905 for two-phase. The value of the chord factor varies according to the desired pitch of the new winding. The average effectiveness of a single-phase coil may be found by calculating the distribution factor with which is combined the effect of the chord factor. The chord factor is the ratio of the sum of the electromagnetic effectiveness of each coil to the sum of their effectiveness at full pitch.

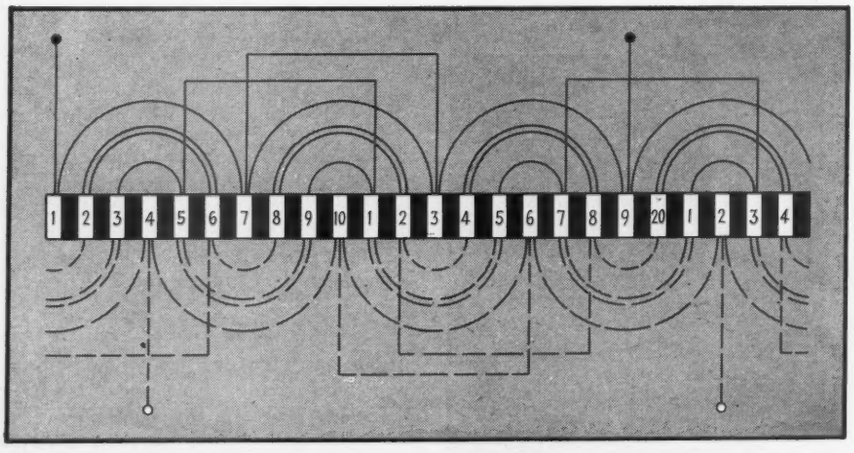


Fig. 1.—A ½ hp., 1750 rpm., 4-pole, 220 volt, 60 cycle single-phase motor with 24 stator slots, squirrel cage rotor and split-phase starting winding shown in dotted lines. Connection: Series.

The main points to be considered in the conversion of a single-phase motor winding into three-phase, while keeping the same speed, frequency, and voltage per turn, are the following:

1) *New horsepower rating.*—The horsepower rating of a single-phase motor rewound for operation on a three-phase supply is approximately 150 percent of the single-phase rating.

2) *Calculation of distribution factor.*—The number of effective turns in a coil is equal to the actual number of turns in that coil multiplied by the sine of half the electrical angle spanned by it. The average of all these values for coils in a pole is the distribution factor of the single-phase winding which also contains the chord factor.

3) *Calculation of the three-phase winding.*—For simplicity, the single-phase number of turns in series, T_1, may be expressed in terms of one of the three phase-windings of the three-phase winding. The complete three-phase winding will consist of three similar windings spread 120 electrical degrees apart in the stator core.

Considering the changes in distribution and chord factor of the modified three-phase arrangement, the number of turns in series per phase for a delta connected three-phase winding will be:

$$T_3 = T_1 \times (D_1/D_3 \times K)_3$$

where T_1 Single-phase number of turns in series
D_1 Single-phase distribution factor and chord factor
D_3 Three-phase distribution factor equal to 0.955
K_3 Three-phase chord factor as calculated.

For a series star connection, the number of turns in series per phase will be T_3 / 1.73.

4) *Calculation of winding wire size.*—For the same line current or size of winding wire, the horsepower rating on three-phase will be 1.73 times larger than on single-phase. However, as the available motor output on three-phase is 150 percent of the single-phase capacity,

A-C Motors PART I

By

Rouel G. Cazanjian

Electrical Engineer
Brooklyn, N. Y.

the size of winding wire to use on a series-star connected stator winding on three-phase will be:

$$Q_3 = 1.5/1.73 \times T_1/T_3 \times Q_1$$
$$= 0.866 \times T_1/T_3 \times Q_1$$

and for a series delta connection, the size of wire will be:

$$Q_3 = 1.5/3 \times T_1/T_3 \times Q_1$$
$$= 0.5 \times T_1/T_3 \times Q_1$$

where Q is the cross-section of winding wire in circular mils.

5) *Other changes.*—Inasmuch as the supply frequency, speed, and the volts per phase or single-phase voltage remain the same, the rotor may be used as is. All auxiliary starting and running devices are removed. In the case of repulsion-start induction-run motors, the commutator is short-circuited with several turns of bare copper wire soldered to it.

Example.—A single-phase induction motor, ½ hp., 1750 rpm., 220 volt, 60 cycle, with 24 slot stator concentric coils, split-phase starting winding, and squirrel cage rotor, as shown in Fig. 1, to be redesigned for operation on a three-phase, 220 volt, 60 cycle, power supply. Each line of winding in the illustration represents 40 turns of No. 19 wire.

1) *New horsepower rating.*—The horsepower rating of the single-phase motor on three-phase will be ½ hp. x 1.50 = ¾ hp.

2) *Calculation of distribution factor.*—The number of slots per pole is 24 slots / 4 poles = 6 which corresponds to full pitch or 180 electrical degrees. The equivalent of one slot is, therefore, 180 / 6 = 30 electrical degrees.

The distribution factor of the winding may be calculated by the following:

Coil Pitch	Number of slots spanned	Equivalent elec. deg. A	½ A	Sin ½ A	Actual turns per coil	Effective turns per coil
1–7	6	180	90	1.000	40	40
2–6	4	120	60	0.866	80	69
3–5	2	60	30	0.500	40	20
				Total	160	129

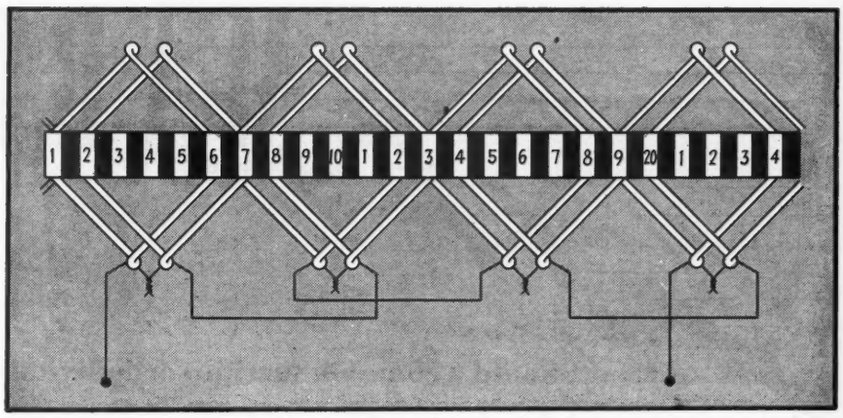


Fig. 2.—Stator core of Fig. 1 rewound with a 4-pole, three-phase winding to operate on a 220 volt, 60 cycle supply. One of the three phase-windings shown. Connection: Series with 2 coils per pole per phase.

The distribution factor of the single-phase winding is, therefore, 129 / 160 = 0.806.

3) *Calculation of the three-phase winding.*—The total number of single-phase turns in series is 160 turns per pole x 4 poles = 640. The number of slots per phase in the three-phase winding will be 24 slots / 3 phases = 8 and 8 slots per phase / 4 poles = 2 slots per pole per phase. Using a two-layer, series connected, distributed standard diamond coil winding, there will be 8 coils per phase. A coil spanning 24 slots / 4 poles = 6 slots and with sides located in slots 1 and 7, will have full pitch or a chord factor of Sin (½ x 6/6 x 180) = 1.

Laying out a coil with full pitch, however, has its disadvantages. A fractional pitch or chorded winding may be favored to reduce: 1) the length of mean turns resulting in stiffer end windings; 2) leakage reactance giving better torque and possibly better power factor and efficiency; 3) Magnetic noise depending on the combination of slot numbers; and 4) the overall axial length of a motor to be designed. With an existing motor chording is often unavoidable in order to properly fit the calculated number of turns in the space between rotor core and end brackets. Chording may also present a solution in cases where the calculated number of turns is not a whole number. Let us assume that one of these conditions exists and the winding pitch is to be shortened to slots 1 and 6, spanning five slots and reducing the chord factor to Sin(½ x 5/6 x 180) = 0.966. A similar arrangement is shown in Fig. 2. This loss of winding effectiveness is compensated by increasing the full pitch coil number of turns in the proportion of 1/0.966 or 3.5 percent. Evidently, the single-phase winding used on three-phase is (0.955 x 0.966) / 0.806 or 1.13 times more effective.

The number of turns in series per phase for a delta connected winding will be:

$$T_3 = T_1 \times (D_1/D_3 \times K_3)$$
$$= 640 \times (0.806/0.955 \times 0.966)$$
$$= 560.$$

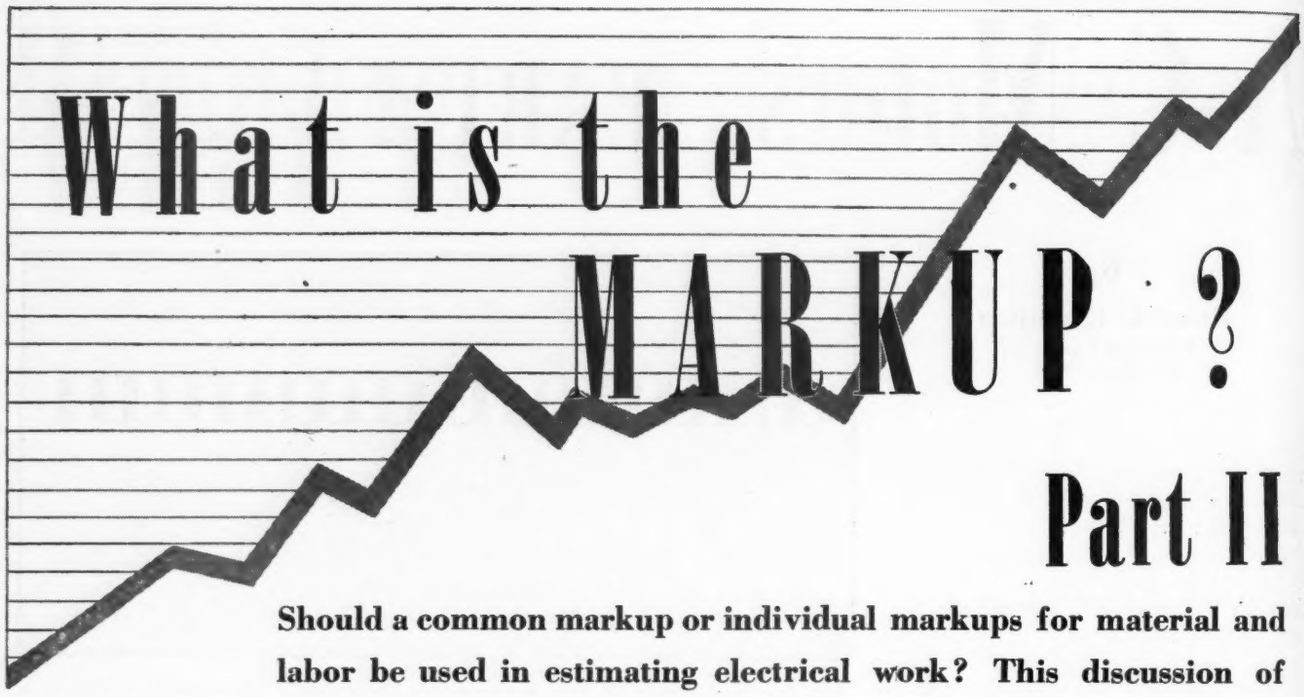
The number of turns in series per phase for a star connected three-phase winding will be 560 / 1.73 = 324.

4) *Calculation of winding wire size.*—The size of winding wire for a series delta connection, based on the size of the old winding using No. 19 wire of 1288 CM., will be:

$$Q_3 = 0.5 \times T_1/T_3 \times Q_1$$
$$= 0.5 \times 640/560 \times 1288$$
$$= 735 \text{ CM or No. 21 wire.}$$

If a series star connection is selected, the size of winding wire will be:

$$Q_3 = 0.866 \times 640/560 \times 1288$$
$$= 1275 \text{ CM. or No. 19 wire.}$$



What is the MARKUP ?

Part II

Should a common markup or individual markups for material and labor be used in estimating electrical work? This discussion of "Labor Overhead versus Material Overhead" discloses the wisdom of applying separate markups proportionate to services rendered.

By Ray Ashley

Research and Consulting Engineer
Chicago, Illinois

THE preceding article on overhead was of a more or less general nature. As readers like to have facts and figures along with generalities, we shall try to limit general discussion and consider something a little more specific, namely: Material Overhead Versus Labor Overhead. On a dollar basis, the *cost of the supply and management of labor, together with tools and equipment, is definitely much greater than the cost of supplying material.* This applies to practically every manufacturing and contracting business. Electrical contracting is no exception.

Lack of appreciation of the full significance of this factor has long had a detrimental influence on the electrical contracting industry. It has resulted in the loss of much of the material business, and in numerous cases, the loss of the business altogether. Individual contractors have suffered financial losses because they supplied installation-only (erroneously called "labor only") services at the same markup used for work including all materials.

To get business moving in the right channels, the electrical contractor has two problems on his hands:

1. To keep the material business which he still has and get back that which he has lost.
2. To protect himself against losses on installation-only contracts.

The answer for a solution to both problems is the same: Divorce labor from material for estimating purposes and markup each according to costs involved and services rendered.

Material Sales

As contractors we complain about buyers taking the material business away from us, and about jobbers and manufacturers dealing directly with the owners. No one has taken anything away from us; we just threw the material sales away by using poor business practices.

The buyers were just smart enough to know that it cost less to supply material than it did to organize, equip, and superintend the labor crews to install it. Since we insisted on getting a substantial price for material, and were willing to take a loss on the installation of it, they decided on an installation-only contract. So long as we are willing to donate our services and the use of our equipment, along with the sale of labor, they will gladly accept our benevolence. With the proper markup on material, this might not happen and we would not be so disturbed about jobbers and manufacturers selling direct to the owner.

If contractors are going to sell material along with labor, they must use a markup for it proportionate to services rendered and not have it bogged down with a markup designed to carry a part of the labor burden. Labor must stand on its own feet.

A good electrical contractor should be able to sell material along with labor. He has men with years of experience who can select the proper materials in the right quantities and get them delivered at the right time. To produce the most economical installation, the man who supplies the labor must have control of the material purchases.

All things considered, for a complete electrical installation, the electrical contractor can give an owner more for his money than he (the owner) can get from any other source. The contractor is also prepared to give a guarantee on delivery and operation. Such a guarantee is worth real money to any owner.

This is not a thesis on selling. However, the above observances are made as a reminder that it is not the total price for complete installation—*but the unbalance between material and labor markup*—which kills the sale of material. Charts have been prepared which show definitely that the owner can benefit by buying material with labor, if the contractor charges his costs where they belong. (See "Installation-Only Projects", E. C. Jan. 1945, pg. 60).

LABOR OVERHEAD VS. MATERIAL OVERHEAD

FOR ELECTRICAL CONTRACTING

APPROX. PERCENTAGES FOR BUSINESS WITH AN ANNUAL VOLUME (BASE JOB COSTS) OF 500,000 DOLLARS
BASED ON SURVEYS OF CONTRACTING FOR A MIXED CLASS OF WORK WITH: (1) AN APPROX. JOB COST RANGE OF 100 TO 80,000 DOLLARS, AND (2) A CONTRACT RATIO OF "60-40"—60% OF THE BASE JOB COST IS FOR MATERIAL AND 40% FOR LABOR.

EXHIBIT—A (FOR REFERENCE ONLY)

APPROX. DIVISION OF DIRECT JOB COSTS WHICH SHOWS THAT, ON A DOLLAR BASIS, THE COST OF THE SUPPLY AND MANAGEMENT OF LABOR IS FAR GREATER THAN THE COST OF SUPPLYING MATERIAL.

NOTE—ITEMS OF DIRECT JOB COSTS SHOULD NOT BE CONFUSED WITH OVERHEAD.

ITEMS OF DIRECT JOB COST	% OF COSTS MAT. (60%)	LAB. (40%)	JOB (100%)	REMARKS
ESTIMATING	1.05	1.35	1.17	SOME PROJECTS ARE ESTIMATED & ENG. SEVERAL TIMES. EXP. ON A SINGLE PROJ. DOES NOT REFLECT COSTS FOR ADJ. BETWEEN JOBS, VACATIONS, ETC. COST OF MISSIONARY WORK IS INCL. IN GEN. OH.
ENGINEERING & DRAFTING	0.80	2.88	1.63	
BLUE PRINTING	—	0.1	0.04	
FIELD SHOP & OFFICE BLDGS	0.14	0.19	0.16	FOR SPECIAL JOBS—SHOWN AS A PRORATA EXP. OF TOT. VOL.
FIELD TEL.	0.03	0.03	0.03	
WIRING & CURRENT—FIELD SHOP & OFFICE	0.05	0.10	0.07	
TOOLS—CONSUMED & DEPRECIATED	—	3.50	1.40	
SELECTING & PURCHASING MATERIAL	0.75	—	0.45	
FOLLOW UP & COORD. DEL.	0.50	—	0.30	
CARTAGE & SPECIAL DEL.	0.10	0.10	TOOLS 0.10	
SUPERVISION	—	2.60	1.04	
TRAVEL EXP.—OFFICE TO JOB	0.10	0.21	0.09	
TIME KEEPER	—	0.50	0.20	REQ. ON THE JOB FOR LARGE CREWS
INSURANCES & EMPLOYEES BENEFITS	—	14.00®	5.60	CHICAGO RATES
INSPECTION (CITY)	0.70	0.80	0.74	BASED ON CHICAGO RATES
INTEREST ON PAYROLL	—	0.50	0.20	CONTRACTOR IS ENTITLED INT. ON MONEY WITHELD
ASSOCIATION DUES	0.20	0.70	0.40	CHICAGO RATES
PRORATA CHARGES	—	0.05	0.02	FOR TEMP. LT. & PR., BROKEN GLASS, ETC.
RESERVE FOR CONTING. & GUARANTEE	0.10	0.50	0.26	
TOTALS	4.43	28.11®	13.90	

®—IN CHECKING OVERHEAD 14.11 (28.11−14.00) IS USED. INS. (14%) IS NOT REQ. TO CARRY THE SAME MARKUP AS LAB.

EXHIBIT—B

APPROX. DIVISON OF
GEN. OVERHEAD & ADMIN. EXPENSE
ITEMS OF OPERATING COSTS
NOT IDENTIFIED WITH ANY PARTICULAR PROJECT

ITEMS OF OVERHEAD EXP.	PERCENTAGES OF COST MAT.	LABOR	THE JOB
ADMINISTRATIVE SALARIES	2.35	8.35	4.75
ENGINEERING & EST. (MISSIONARY WORK)	0.40	1.40	0.80
BOOKKEEPING—GEN.	0.92	1.40	1.11
BOOK KEEPING—SPECIAL TAXES & INS.	0.20	1.57	0.75
STENO. & TEL. OPER.	0.25	0.88	0.50
STORE RM. ATTENDANT & SHOP MECH.	0.35	1.23	0.70
UTILITY BOY	0.18	0.65	0.37
RENT—OFFICE (HEAT INCL.)	0.35	1.23	0.70
RENT—STORE ROOM (HEAT INCL.)	0.10	0.35	0.20
LIGHT	0.06	0.21	0.12
TELEPHONE	0.25	0.50	0.35
OFFICE EQUIP. & FURNITURE	0.12	0.43	0.24
STATIONERY, EST. FORMS & MISC. SUPPLS.	0.23	0.40	0.30
POSTAGE	0.10	0.20	0.14
TAXES, LICENSES & LEGAL EXP.	0.12	0.43	0.24
ADVERTISING	0.12	0.43	0.25
INSURANCE ON EQUIP. & MISCL. EXP.	0.33	1.13	0.65
RESEARCH & TIME STUDIES	—	0.40	0.16
AUTOS, TRAVEL, & MISC. PROM'TL. EXP.	0.33	1.13	0.65
ADJ. FACTOR (7 NORMAL & 3 BAD YRS. IN TEN. ORG. MUST BE MAINT. IN OFF YRS.)	0.20	1.57	0.75
TOTALS	6.96	23.89	13.73

FIG. 1—Approximate division of operating costs for an electrical contracting business with an annual volume of $500,000 (base job costs). Exhibit "A" is for direct job costs; Exhibit "B" for general overhead and administrative expense. Note ratio of cost of supplying and managing labor versus that for supplying material.

Installation-Only Projects

The principal function of an electrical contractor is to supply, *manage and supervise* the labor necessary to install an electrical system. This embraces much more than merely furnishing mechanics for the job. It involves, in addition to the selection and supply of proper tools and equipment, the selection of efficient men and planning of a work schedule that reduces non-productive man-hours to an absolute minimum. By the same token, the principal cost of the business is chargeable to *labor services.*

Exhibit "B" Figure 1, indicates that, on a dollar basis, the overhead cost of supplying labor is approximately 3½ times as great as the cost of supplying material. Exhibit "A" shows a similar ratio (insurances not included) for operating costs. The item of insurances is not included since from the standpoint of operating cost, it is little more than a merchandise transaction.

To see just what would happen if a common markup were used for both complete installations and installation-only projects, let us set up some figures. Since the ratios (Material to Labor) of job costs and overhead as shown here are approximately the same, for the sake of those who have no careful segregation, we shall use a combination of the two.

For Material we have
4.43 + 6.96 = 11.39 percent
For Labor we have (28.11 − 14.00) or 14.11 + 23.89 = 38.00 percent
Overall (see Job Col.) = (13.90 − 5.60) + 13.73 = 22.03 (use 22 percent)

This same over-all figure (The Job) could be readily established if only the two divisions were available.

Since the percentages are for a 60/40 business, the figures would be:

For Material	**0.60 × 11.39 =**	
6.83 percent		
or Labor	**0.40 × 38.00 =**	
15.20 percent		
Totals		
22.03 percent		**1.00**

This can be figured in another way. Let's take a $10,000 job and use the individual markups of 11.39 and 38 percent for material and labor respectively. A $10,000 (base cost) job with a 60/40 ratio would require $6,000 for material and $4,000 for labor. Applying the above percentages we have:

11.39 percent markup on $6,000 = $683.00
38.00 percent markup on 4,000 = 1520.00

Total Markup
$2203.00 or 22.03 percent of $10,000

Therefore applying the over-all 22 percent markup the combined cost of labor and material would give the same result as using the individual markups of 11.39 percent for material and 38 percent for labor.

The above figures were established on surveys of annual volumes, embracing a variety of types and sizes of jobs. To avoid getting into more calculations, we shall assume that they fit a particular case.

If a contractor sold the complete installation with a markup of 22 percent for job costs, and 10 percent for return,

[Continued on page 182]

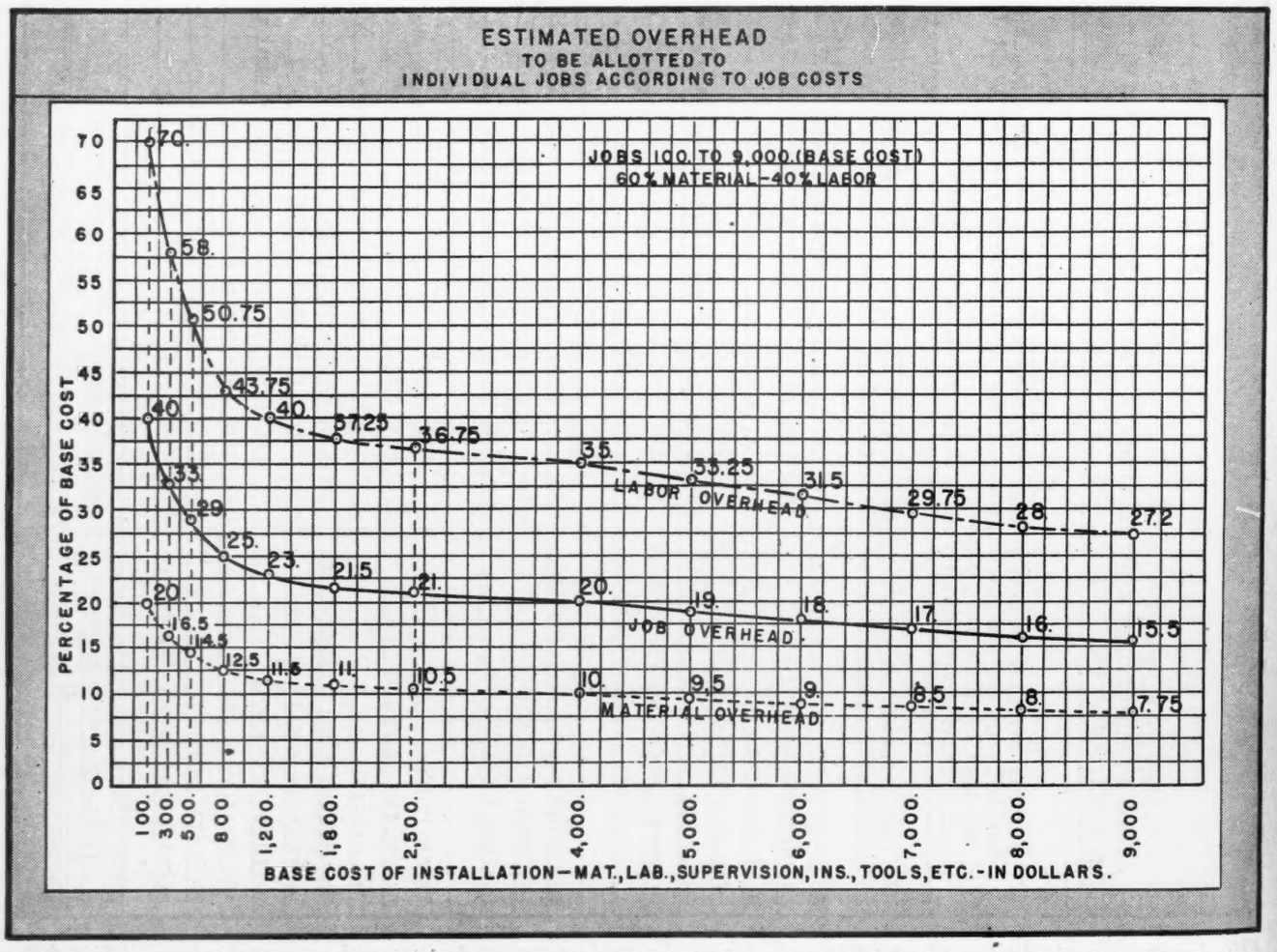

ESTIMATED OVERHEAD
TO BE ALLOTTED TO
INDIVIDUAL JOBS ACCORDING TO JOB COSTS
JOBS 100 TO 9,000 (BASE COST)
60% MATERIAL - 40% LABOR
LABOR OVERHEAD
JOB OVERHEAD
MATERIAL OVERHEAD
PERCENTAGE OF BASE COST
BASE COST OF INSTALLATION—MAT., LAB., SUPERVISION, INS., TOOLS, ETC.-IN DOLLARS.
70. 58. 50.75 43.75 40 37.25 36.75 35 33.25 31.5 29.75 28 27.2
40 33 29 25. 23. 21.5 21. 20. 19. 18. 17. 16. 15.5
20. 16.5 14.5 12.5 11.5 11. 10.5 10. 9.5 9. 8.5 8. 7.75
100. 300. 500. 800 1,200. 1,800. 2,500. 4,000. 5,000. 6,000. 7,000. 8,000. 9,000

FIG. 2—Chart showing how estimated overhead for material, labor and job varies with base cost of installation. Figures are for "60/40" jobs with base costs ranging from $100 to $9,000.

Sponsor of the St. Louis Residential Wiring School is the Joint Apprentice Training Committee. Members shown are: (L to R) John T. Meinert, president, Local No. 1, IBEW; Russell E. Vierheller, secretary - manager, St. Louis Chapter, NECA; Leo J. Hennessey, secretary and James A. Morrell, business manager of the union.

Contractors and Union act to forestall skilled labor bottleneck in St. Louis residential wiring market. Men receive twelve weeks training in fundamentals and residential wiring techniques.

Training House Wiremen in St. Louis

By August Eckel

FEBRUARY 28 was graduation night for some 80 members of IBEW Local No. 1 in St. Louis, Missouri. They had just completed the course of instruction at the Residential Wiring School—a new labor-management approach to the problem of speeding new home construction.

Faced with a serious shortage of skilled "house wiremen," the Electrical Contractors Association of St. Louis (NECA Chapter) and Local No. 1, IBEW (AFL), through a Joint Apprentice Training Committee, inaugurated a residential wiring apprenticeship program. It covers 12 weeks of instruction at the Hadley Technical High School in St. Louis plus three months of probationary employment with a contractor. Men who successfully weather both "courses" are eligible to take the Union examination and—if they pass—come out with a residential journeyman's card.

Instruction at the school is handled by five union members, Neil Butteiger, Steve Speck, Roy Stahl, Ray Kaercher and Leo Brunner, all selected expert residential wiremen who passed tests given by the St. Louis Board of Education. They teach four, three-hour classes per week. One group of students attend Monday and Wednesday nights; the other Tuesday and Thursday nights.

The course of instruction is evenly divided between theory and practical wiring techniques. One night a week is devoted to fundamental theory, the electrical code, blueprint reading, mathematics and related classroom subjects. On the other night, practical wiring techniques are taught and demonstrated.

To facilitate practical wiring training, a skeleton frame of a six-room bungalow—paid for jointly by the contractors and the union—was built on the second floor of the school (a high ceiling room). An adequate wiring layout, made by the adequate wiring division of the St. Louis Electrical Board of

(Continued on page 134)

Faculty: (front row, L to R) instructors Leo Brunner and Neil Butteiger. Standing (L to R) Roy Stahl; Carl W. Brown, Steve Speck; and H. F. Church, principal.

One of the classes that attended the first "semester" of the St. Louis Residential Wiring School. A second group started on March 4.

G.I. SKILL CREDITS

Minnesota plan sets up specific rules for crediting service acquired skills to apprenticeship and state license requirements.

JUST what credit should be given an ex-serviceman for the electrical experience or training he received in service when he applies for a job or training in the electrical construction industry? That has been, and still is, a confusing issue with many electrical groups throughout the country.

The Minnesota Electrical Council, Inc., recently released a set of "credits" which, if not the complete answer to the problem, will at least offer a basic guide toward some standard determination of credit due servicemen. Approved by the Joint Industry Committee representing the Minnesota Electrical Council, Inc.; the Minnesota Electrical Workers Council and the Minnesota Electrical Inspectors Association, this document heralds the first apparent action of its kind in the country. The document bears the title "Recommendations of Electrical Industry Committee on Veterans and War Industry Service Credits to be Applied to State License and Apprenticeship Requirements."

MINIMUM REQUIREMENTS
MINNESOTA STATE ELECTRICAL WIREMAN
AND SHOPMAN APPRENTICESHIP STANDARDS

Practical Experience

Electrical Shopman	Hours	Electrical Wireman	Hours
A. Cleaning motor, generator and starter parts	140	A. House wiring installation	500
B. Dismantling motors and generators, marking parts and terminals in the shop to insure correct assembly	140	B. Conduit--concealed	500
C. Stripping windings	240	C. Conduit--exposed	500
D. Winding coils--armature and stator	540	D. Metal moulding installation	300
E. Sleeving, taping & insulation coils	500	E. Office building installation	300
F. Cutting & fitting slot insulation	80	F. General wiring installation	1000
G. Taking data & filling out data cards	80	G. Maintenance work	300
H. Minor repairs--fractional H.P. motors	160	H. Motor trouble and repairs	500
I. Minor repairs--electric fans	160	I. Motor wiring & connections	500
J. Appliance Repairs	120	J. Fixtures--house & commercial	500
K. Rewinding fractional H.P. motors	700	K. Sign wiring--servicing & hanging	300
L. Rewinding field coils--D.C.	300	L. Underground wiring--parking lot--filling station--street lighting	500
M. Rewinding stators--1 H.P. & up	1620	M. Farmstead wiring	1000
N. Rewinding armatures & rotors	1620	N. Temperature control	400
O. Commutator repairs	100	O. Sound & telephone installation	300
P. Commutator building	100	P. Reserve for other work	600
Q. Connecting motors, generators, starters & transformers	160		
R. Generators, starters & controls	260	Total	8000
S. Switchboard building	160		
T. Switchboard repairs	160		
U. Connecting test motors	80		
V. Stock keeping & stockroom records	80		
W. Lathe work	200		
X. Milling machine work	100		
Y. Hydraulic & wheel press	100		
Z. Repair shop records	100		
Total	8000		

A variation of 20% plus or minus in the above listed work processes shall meet with approval, provided the total of 8000 hours is accounted for.

In addition to the above practical experience (covering a 4-year period), each apprentice must attend classes in related subjects at least 144 hours per year (total of 576 hours for 4-year period).

In setting up this credit rating, the committee—in its common desire to allow reasonable and practical credit for training or experience gained by veterans—interviewed many individuals (including veterans) and agencies.

Individuals in authoritative positions agreed that the type of electrical training and experience gained by men while in the Armed Services has been, in the main, highly specialized. However, the committee felt that full credit in terms of months spent in specialized training schools should be given against the required years of experience for a journeyman electrician's license; that time at the rate of 40 hours per week in school be allowed against the required total for apprenticeship training. Additional full credit should be given to those who attend more than one school—provided their records indicate satisfactory completion of the school courses.

The credit ratings appear in the following table:

Recommended Veterans Service Credits Toward Electricians License and Apprentice Training in Minnesota.

Service Training	Period	Credits to be Applied Toward	
Service Branch and Subject		State License	Apprentice Training
Class A Navy Training School—Fundamental electricity, electric equipment and communications	16 weeks	16 weeks	640 hours
Class B Navy Training School—Continuation of Class A Course	16 weeks	16 weeks	640 hours
Class C Navy Training School—Washington, D. C. — Advanced electricity and communications	32 weeks	32 weeks	1,280 hours
U. S. Army Training Course—Mechanical and Electrical Fundamentals	3 months	3 months	480 hours
U. S. Army Training Course—Junior Radio and Communications	3 months	3 months	480 hours
U. S. Army Training Course—Radar and Electronics	3 months	3 months	480 hours
U. S. Coast Guard and Merchant Marine Service		Credits to be based on individual records and proof of electrical experience.	

[Continued on page 136]

Where corrosive vapors and dust *are a problem...*

WESTINGHOUSE MILLITE, with vapor and dust-tight cover of heat and impact-resisting glass. Easy to service. Available in 300 to 1000-watt incandescent and 400-watt mercury types.

The Millite is especially designed for steel mills, foundries, chemical plants, boiler rooms, welding shops, railroad shops—wherever excessive dust or moisture in the air might cause corrosion or excessive maintenance of open-type luminaires.

Millite provides controlled illumination in high bay areas. The heat-tempered, impact-resisting, hinged glass cover permits easy access for lamp replacement.

Remember—if you need help on this or other industrial lighting applications—*"It will pay you to call a Westinghouse Lighting Specialist".* Just contact your nearby Westinghouse Distributor. Or write for Millite folder F-8408-A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04096-B

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PLANNED LIGHTING

AVAILABLE THROUGH 127 WESTINGHOUSE ELECTRIC SUPPLY OFFICES AND INDEPENDENT JOBBERS

$\tan\theta = \frac{y}{x}$

Function of a Buyer's Laboratory

$\phi x = c\int \frac{dx}{x}$

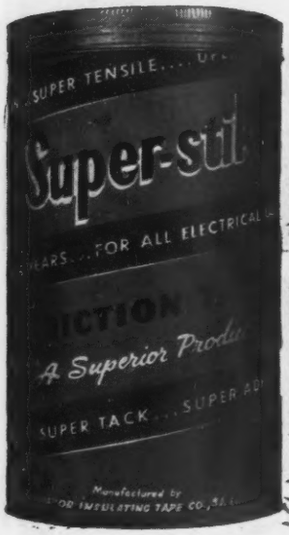
To be able to reach for the right answer

In the year's time that Super-stik has been available, it has proven itself the choice of fine craftsmen. Developed for the extra hard usage of war, Super-stik, a Mintert calender-process tape, has lasting tacky properties of superior quality. Easy to unroll. Clean on the hands, it doesn't curl or unwind in service. When applied it sticks and sticks—and sticks. Ask any authorized electrical wholesaler for a sample.

SUPERIOR INSULATING TAPE CO., ST. LOUIS, MO., U. S. A.

Established 1923

Write for a free "test-it-yourself" splice. Mailed without charge.



PACKED 10 ROLLS TO THE CAN

Super-stik

FRICTION TAPE

"Sticks to the End"

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

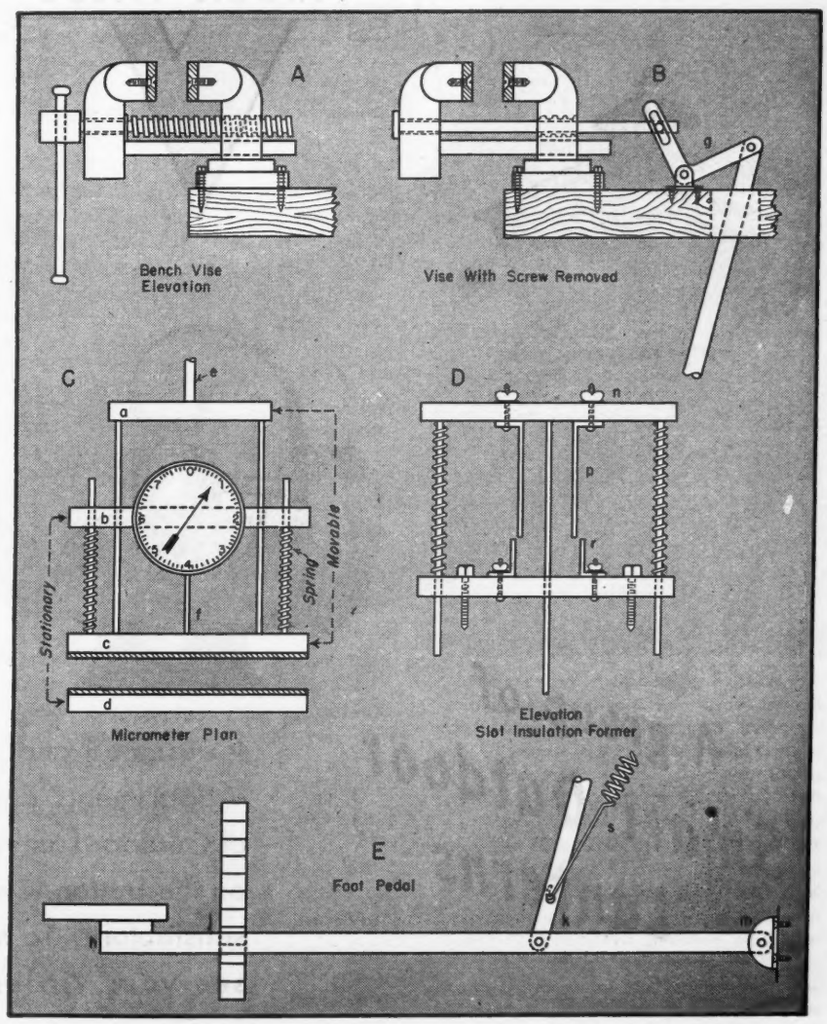
FOOT PEDAL CONTROL SPEEDS EFFICIENCY

INDUSTRIAL

In every shop there are many operations where the worker claims an extra hand would be greatly appreciated. Both accuracy and speed would be improved if a third hand could be casually issued to each operator for use in his work. The automotive industry recognizes this fact by dividing driving operations between hands and feet to free the hands from clutch, brake and gas regulation. Photographers take the idea into the dark-room and use foot pedals for controlling enlarger and safe-lights while hospitals apply the theory in regulating the flow of water at washstands. Many shop applications suggest similar opportunities for reducing manual demands and it becomes apparent that a third hand theoretically can be furnished the operator who uses his head—and uses his feet.

A trip through the shop of the Everson Electric Company, Allentown, Pa., reveals numerous applications where employees work with both hands and feet. Bench vises can be instantly tightened or loosened through the foot pedal arrangement diagrammed in sketches A, B and E. The jaws of the common bench vise are moved by turning a hand spoke which in turn rotates a worm screw and, through the exertion of pressure on the threads in the bench mounted base, forces the movable jaw either towards or away from the stationary jaw. Sketch B shows the vise with hand spoke and worm screw removed. A long steel bolt, smaller in diameter than the clear bore through the vise base, is substituted for the worm screw and, with the contact between worm teeth and shoulders eliminated, the movable jaw of the vise can be moved in or out by moving this bolt. The right-angle pivot and toggle devise (B-g) converts the horizontal bolt action to an inclined movement of the shaft passing downward through a hole cut in the work bench and joining the foot lever (E-k). The foot lever, pivoted to a rear bench support (E-m), is motivated by the foot pedal (E-h) and arcs up and down adjacent to a saw-tooth pawl (E-j). By the lever principle, a normal pressure on the foot pedal exerts a downward multiplied force on the shaft running to the toggled pivot on the bench top (B-g) and the resultant horizontal pressure on the vise bolt clamps the vise jaws. To release the jaws, the operator presses the foot pedal to one side, disengaging the pedal lever from the holding pawl. A spring (E-s), fastened from a point on the inclined shaft to a higher terminal, pulls the shaft upward and forces the vise jaws apart. To prevent damage to coils or soft materials held in the vises, the steel facing plates can be removed and fibre plates reinstalled.

During the process of checking thicknesses of coils, slot wedges, commutator bars and wire diameters, a micrometer is a necessary instrument although it is often inconvenient to free one's hands for the required adjustments. The employment of a dial micrometer becomes ef-



Common bench vise (A) may be operated by foot pedal (E) when toggle arrangement and bolt (B) are substituted for worm screw and turning spoke. Foot pressure may also activate micrometer (C) for checking thicknesses or slot insulation former (D) for creasing dielectric paper.

A group of Smart Outdoor Lanterns

• Designed and styled for today's markets—apartments and houses—the Virden line of Outdoor Lanterns hits current needs right on the button. Demand is strong, shipments satisfactory. To make sure of requirements, see your Virden wholesaler promptly.

John C. Virden Company • Cleveland, Ohio

Member American Home Lighting Institute

fortless, rapid and involuntary when using the arrangement sketched in C. The plan shows the dial micrometer fastened to a stationary crossbar (b) and so calibrated that the reading on the dial becomes zero when the movable jaw (c) is in contact with the stationary jaw (d). As the jaws are separated, the stem (f) activates the indicating hand and the separation of the jaws becomes the thickness of the material being measured. Using the same pedal and bench toggle arrangement illustrated in sketches B and E, a horizontal shaft (e) is caused to exert a pull on the yoke (a) and (through the two connecting bars) the movable jaw (c). As the jaws separate, the operator inserts the material being measured. Reducing the foot pressure releases pressure on the horizontal shaft (e), yoke and movable jaw. Springs, mounted around guiding dowels in the micrometer assembly, force the jaws snugly against the material being calibrated and an accurate reading is immediately indicated on the dial.

A third application, roughly illustrated in sketch D, facilitates the creasing of slot insulating paper. The sketch shows an End Elevation with all plates and angles extending away from the eye a distance of a foot. Slot insulation groove width is adjustable by loosening the wing nuts (n), moving the top and bottom angle irons (p and r) together or apart and re-tightening the nuts. Foot pressure raises and lowers the upper plate in conjunction with the vertical movement of the two end dowels passing through the lower plate to a yoke beneath the work bench. Foot pressure lowers the upper plate while the four corner springs between the plates raise the upper plate when foot pressure is released. Insulation is placed across the bottom pair of angle irons, the foot pedal is tapped, the upper plate descends and springs upwards again and the slot insulation is formed. Accuracy and speed have resulted and the hands of the operator have remained free for guiding and stacking the papers.

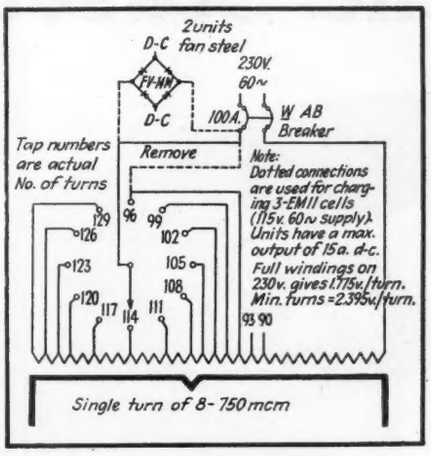
HIGH CURRENT TEST TRANSFORMER

By EMMETT J. KEOUGH,
Iowa Electric Light & Power Co.
Cedar Rapids, Iowa

WIRING

Have you ever wanted to force several thousand amperes through a circuit breaker? Or observe the current necessary to fuse different size wires? Or maybe you want to do some brazing on heavy conductors.

These problems and many more are



Shop-constructed transformer used for wide variety of electrical jobs.

easy to perform if you have the facilities and ambition to build up a transformer as per diagram.

I find uses for this piece of equipment very frequently, the most recent being a source of variable voltage supplying selenium rectifier units to charge three lead cells.

The only new material required was the single turn secondary and the tap switch. An old defective 15 kva. distribution transformer was found to have a good 110/220 volt winding (usually the case). The core was completely dismantled and the 110/220 v. copper saved. A wood form was shaped and 90 turns were placed before taps were started, then a tap was brought out on every third turn. Taps were made of flat strip silver-soldered to turns and brought out to the end of the coil. After the new primary was completed, the one turn secondary was designed to fill up the space left in the core window. Some bar copper 1¼-in. by 2 in. was used for the terminals and eight single turns of 750 mcm. bare stranded cable were hi-pressed into these bar terminals.

It wasn't practical to heat this mass of copper to brazing temperature, so a die was made for an arbor press and after the turns were formed and holes bored, the ends were inserted and the indentations were pressed in—securing the cables to this parallel bar.

A little forethought was given to the possibility of changing this for series-parallel and half of it was insulated so that the bars could be cut in half for a series arrangement (giving double the output voltage). These bars were drilled and tapped so that flexible leads could be attached readily. In order to read this current, multiple leads were made from flexible welding cable. The ends were stripped and all inserted in copper tube which was then forged flat and a hole drilled. This method made it possible to use a clamp-on ammeter over one wire and multiply by the number of wires.

The primary makes an excellent auto-transformer for variable outputs with secondary idle.

I have used it to expand large ball bearing raceways, heat bar iron to welding temperatures, butt-weld steel tubing, spot weld sheet steel, silver solder and braze heavy copper parts, test instantaneous tripping of breakers, motor starters, etc., thaw frozen water pipes, and many other heating and testing problems. If a continuously adjustable auto-transformer is used in the supply line, the output is kept under perfect control.

While brazing non-ferrous metals it is most practical to use carbon blocks between some clamping device, because of the high conductivity of these metals. Having the taps correspond with the number of turns and the single turn secondary, makes the ratio simple on any tap so that primary current and voltage can be measured and converted to secondary values.

On intermittent testing, overloads up to short circuit values can be tolerated. It is used as an open type air cooled unit.

Reelbarrow for handling branch circuit conductors is used extensively in the electrical reconversion work at the Kaiser-Frazer Willow Run plant in Michigan. The device has a welded frame constructed of 1-inch pipe so designed that it will accommodate four 18-in. dia. reels of building wire. Each reel can be lifted off the rack independently and reloaded with a coil of wire. Two heavy-duty casters provide the mobile feature of the rack which can be pushed in and out of conventional doorways (conditions encountered in apartment house, office building and hospital work). Turner Engineering Company, Detroit, is the electrical contractor on the Kaiser-Frazer project.

Between the Seasons

ELECTRICAL CONTRACTORS

Order now for summer installations. Write today for new Bulletin No. 73.

Spring and Fall have many chilly days and evenings, too, that need just a little *Extra Heat.* That's when the Ⓕ Electric QUIKHETER proves its worth in delightful warmth . . . filling an average room in just a few minutes.

Best of all, the Ⓕ QUIKHETER has no moving parts to wear out, and a genuine Nichrome element that should *never* burn out under normal operating conditions. Built into the wall it takes no floor space and eliminates the hazards of exposed cords.

It costs no more than many portable models, yet lasts a lifetime. Separate control switch* locates high on the wall, away from children's inquisitive fingers, where you can reach it without stooping.

The Ⓕ QUIKHETER is an *auxiliary* electric heater providing *extra* warmth for the morning shower, baby's bath, drying hair, and chilly mornings before the regular heating system is started.

*Not furnished

BUILT-IN ELECTRIC

FA QUIKHETER

Frank Adam Electric Co. BOX 357 ST. LOUIS MISSOURI

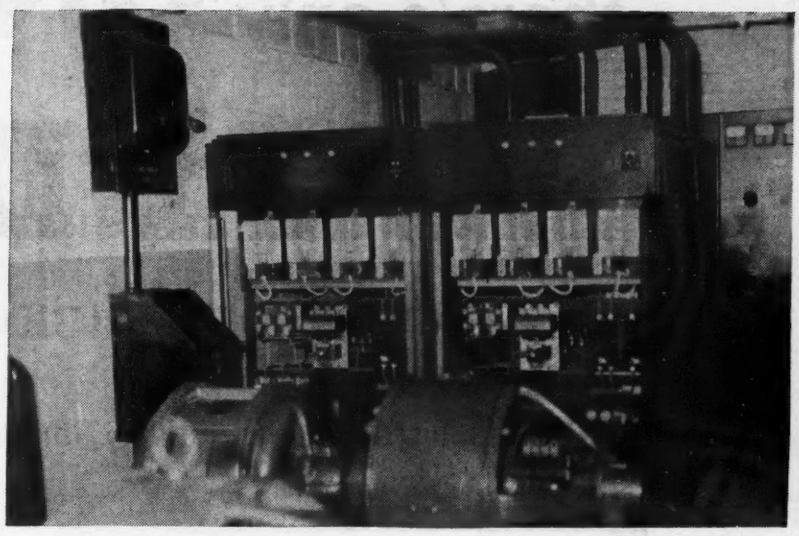
RECTIFIERS MINIMIZE MAINTENANCE

INDUSTRIAL

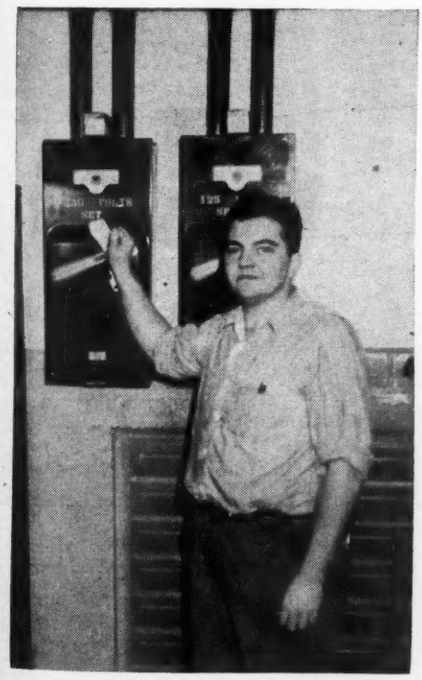
The maintenance of d-c rectifying equipment has been simplified through the installation of four industrial rectification units at the Arvey Corporation, Jersey City, N. J.

Although the plant is lighted and partially powered with a-c; elevators and exhaust fans require d-c which was formerly supplied by two motor-generator sets operating from three phase, 60 cycle, 220 volt input. The combinations linked a 60 hp. Westinghouse motor with a 40 kw., 1750 rpm., 250 volt, 160 amp. generator and a 40 hp. General Electric motor with a 25 kw., 1150 rpm., 150 volt, 163.3 amp. generator.

Four units designed by the American Transformer Company of Newark, N. J., were recently installed; each unit designed to convert 208 volts, 3 phase, 60 cycle a-c to d-c for the operation of all types of d-c equipment generally found in industrial plants. The maximum rectified output is 200 amps. at 125 volts per unit. Two units, installed with their outputs in parallel, now deliver 400 amps. at 125 volts while the other two units, in series, produce an output of 200 amps. at 250 volts. Housings consist of welded steel frames mounted around the rectifiers, side panels of wire mesh screening and front access panels. Control switches are mounted on the top of the front panels while the doors permit access to fuses, control relays, rectifier tubes and connections.



Remote control, minimum maintenance, automatic features to protect both equipment and personnel and operation by men with a minimum of technical knowledge or skill are advantages of the four industrial a-c — d-c rectifiers.



Herbert Adams, plant maintenance engineer of the Arvey Corporation, finds that maintenance of the rectifiers is a matter of routine inspection and the infrequent replacement of tubes, fuses and pilot lamps.

The plant maintenance engineer reports that the rectifiers have many advantages over the motor-generator sets which are still retained and maintained as standby equipment. Without any moving parts; oiling, undercutting, brush and bearing replacement is eliminated. Operation is silent. Remote control is possible and it becomes unnecessary for a trained electrician to start or stop the units. Maintenance has been reduced to the routine checking and infrequent replacement of pilot lamps, fuses and tubes.

REMOVING SYNTHETIC RESIN INSULATION

WIRING

A practical method for removing synthetic coverings from fine electrical wire, developed by the Fairchild Camera and Instrument Corporation for use in their Jamaica, N. Y., plant, is now available for use by the electrical trade.

What are generally referred to as the assets of resinous insulation—toughness, flexibility and resistance to normal solvents and heating—are also sources for promoting mechanical weakness in wires when subjected to normal methods of stripping. Especially applicable to wires ranging in size between 36 and 55, cross sectional areas are noticeably reduced when insulation is removed by scraping, abrasive cloths, rotating wire brushes, burning with gas fired flames and dipping in high temperature solder. Caustic solutions and acid baths are sources of potential danger to operators as well as to the wires. It has been the experience of the Fairchild engineers that the popular method of stripping and tinning with hot solder has the deleterious effects of embrittlement, charring the covering adjacent to the stripped section and materially dissolving or causing necking of the wires. Number 44 wire was often effectively reduced to size 48 and it was difficult to maintain original engineering specifications in delicate instruments.

The new "Dip-n-Strip" method creates no noticeable change in the physical properties or wire size. All types of synthetic coverings, including Formex and Formvar up to size 55 as well as wires covered with enamels, nylon and other synthetics, can be removed in a small fraction of the time formerly required. Two chemical solutions are used in the process, the first of which is maintained at approximately 430 degrees F and the second kept at the near-constant temperature of 140 degrees F with the aid of a controlled water bath. The fine wire is dipped in the first solution for a few seconds to the desired depth of the stripped lead. It is then dipped in the second solution to a slightly greater depth for the same time interval. A few strokes of the fingers remove all traces of insulation and a full section, clean wire results. The method is quick, simple, involves minimum handling and leaves the section undamaged.

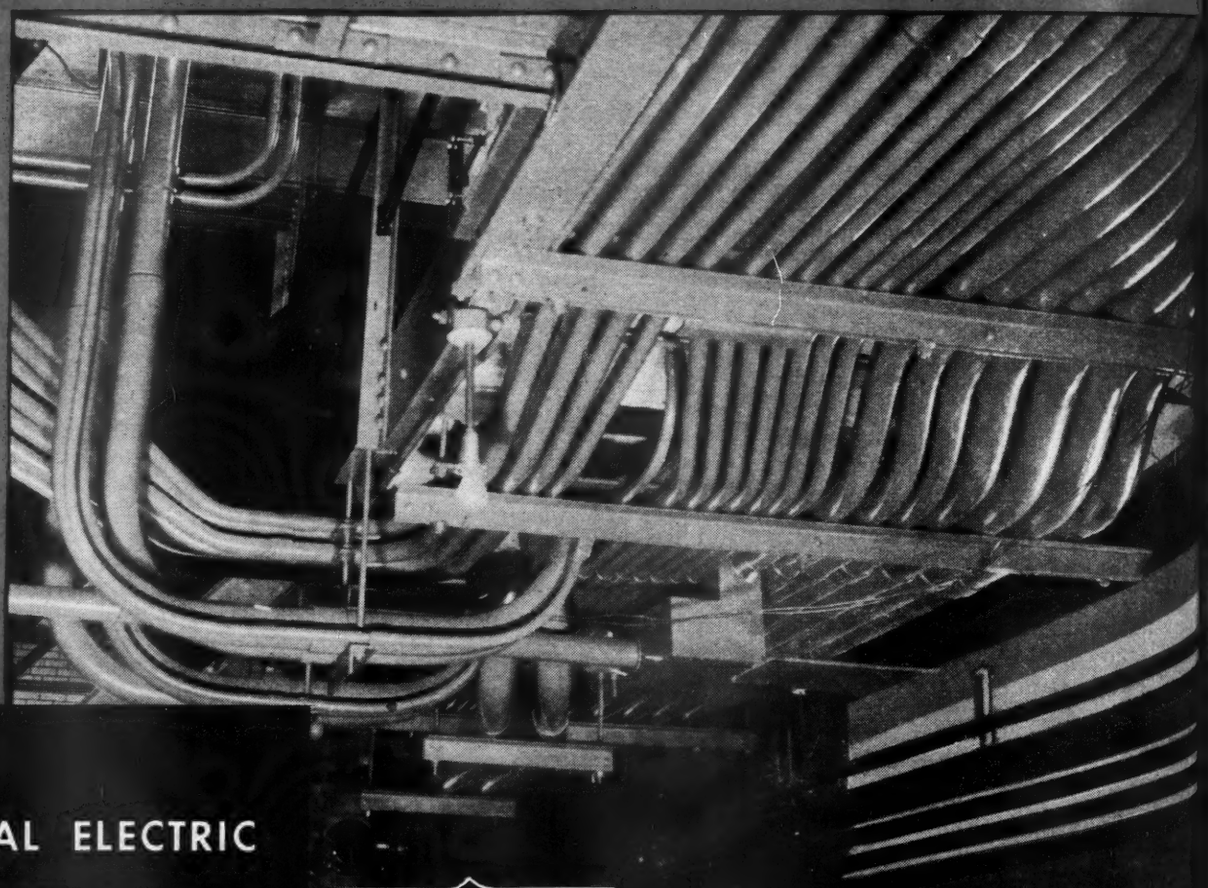
After 18 months of constant use, the method has proved to be non-toxic to the employees and in no way chemically harmful to either the wire or finished product. Desirable benefits are apparent in the manufacture or repair of radios, radar, television sets, household appliances and all fractional hp. motors.

there's only **ONE**...

SHERARDUCT

FULL WEIGHT - THREADED - RIGID STEEL CONDUIT

SPECIFY NATIONAL...Distributed exclusively through Electrical Wholesalers



NATIONAL ELECTRIC
SHERARDUCT is better

- ★ BENDS EASILY
- ★ RUSTPROOF
- ★ SMOOTH INSIDE
- ★ EASY FISHING

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES

National Electric
PRODUCTS CORPORATION
Box 897 — Pittsburgh 30, Pa.

WIRING MULTIPLE DWELLINGS

WIRING

Due to the fact that a greater number of families can be housed on a smaller land area and at a smaller cost per housing unit, the building and alteration of multiple dwellings is receiving favorable attention and approval in many cities and heavily populated residential areas.

These multiple dwellings are coming into being through the alterations of existing structures, the erection of garden apartments and the building of higher apartment dwellings. Older houses, formerly the homes of single large families, are undergoing changes to permit the housing of a number of individual families; garden apartments are concentrating families in small attractive units which are parts of a planned settlement, and apartment houses are reaching to the sky for living space in a yet more concentrated form.

When the cost of electrical conveniences and services can be distributed in small rental increments among a large number of residents, many desirable features (prohibitive for the individual) become possible and feasible. Listed in this classification are recreation facilities with provision for electrical exercise equipment and hobby rooms such as electrically equipped woodworking shops and photographic dark rooms.

Electricity is playing a major role in the lighting of foyers, lobbies, hallways and exterior landscaping or architectural features. Heating controls, sump pumps, motors for powering rubbish hoists and the like, air conditioning units, laundries with electric washing, drying and ironing units, elevators, communication systems, drinking fountains and germicidal lamps are also receiving the attention of owners, architects and builders. Heavier conduit is being run to the individual apartments to supply power for the many appliances which tenants are purchasing to fulfill their personal desires.

In cases where electrical contractors are requested to plan the wiring for these multiple dwellings or to suggest the possible scope of an electrical system, it is well to have in mind the various items which may require attention. The accompanying suggestive list should prove of value.

CHECK LIST FOR WIRING MULTIPLE DWELLINGS

Air conditioning
Alarms—fire, burglary
Annunciators
Bell ringing transformers
Compressors
Controls—heating, lighting
Drinking fountains
Dumbwaiters
Door locks and openers
Dryers—laundries
Elevators—freight and passenger
Fans—cooling, exhaust, ventilating
Floor polishers
Floor Waxers
Germicidal lamps
Heating—stokers, oil burners
House numbers—illuminated
Hot water circulating pumps
Humidifyers
Incinerator light and door switch
Irons
Ironing machines—laundries
Radiant heaters
Radios
Ranges
Refrigerators
Refrigeration
Signs—elevators, exits
Television sets
Tools—power
Vacuum cleaners
Ventilating systems
Washing machines—laundries
Water heaters
Water purification filter

Illumination—general recommendations

Foyers, lobbies, halls, elevators
5 to 10 footcandles
Switchboard, mail desk, garages
15 to 25 footcandles
Recreation rooms, repair shops
20 to 25 footcandles
Minimum size of wiring throughout building—No. 12.

NON ROLLING PORTABLE LAMP

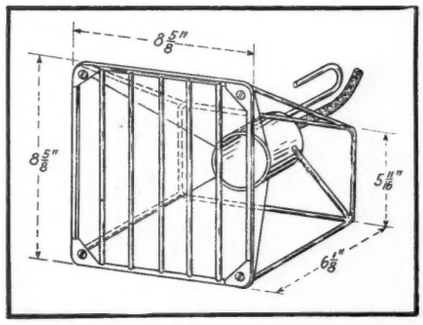
WIRING

Extension lights are generally housed in round wire cages and either suspended above the work areas or placed on the working surface to provide general illumination. Without reflectors, these lights emit annoying glare and the effective light concentrated on the job is reduced through dispersion. When placed on a slight incline the lamps are free to roll, a tendency which often involves an element of danger as well as inconvenience.

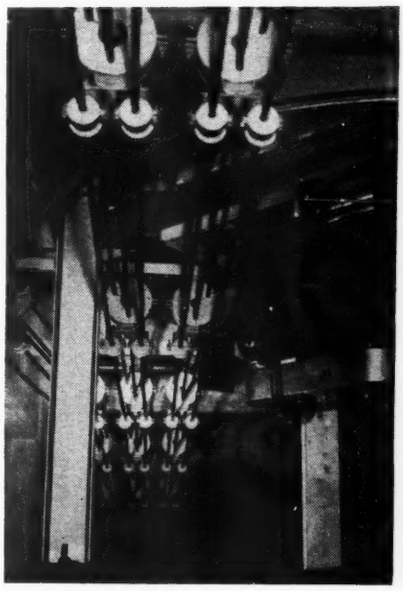
E. C. Montgomery, one of the workers employed by the Moore Dry Dock Company of Oakland, California, developed a portable reflecting lamp to overcome these objections and to facilitate work in tight places such as the double bottoms or fore and aft peaks of ships.

The reflector consists of a truncated polished aluminum shield designed with a 50 degree slope and of sufficient depth to accommodate a 100-watt lamp. The reflector is enclosed in a heavy (number 6) wire cage which is built square on the face around the open edges of the reflector and rectangular at the socket. The cage measures slightly less than 9 inches on a side and is approximately 6 inches from the face to the base of the porcelain socket which is supported by prongs rising from the rear corners of the wire cage.

When placed on a flat or slightly inclined surface, the lamp no longer rolls and the light may be directed in a concentrated beam on the working area from the most advantageous angle. A hook makes it possible to hang.



Heavy wire cage, built in form of truncated pyramid, encloses reflector of polished aluminum. Lamp is prevented from rolling when placed on inclined surfaces and beam may be directed on work from most effective location. Hook in base assembly facilitates lamp suspension above work.



Open wiring circuits feed electric nitriding furnaces at the Chrysler Corporation's Dodge - Chicago Plant where B-29 engines were built. Split porcelain insulators in double-tier arrangement support conductors. This wiring method, used extensively throughout the plant, saved considerable quantities of steel and copper at a time when these metals were extremely critical.

Always a 5-star favorite with Wholesalers, Contractors, Dealers. Why? Because Security is:

★ Non-ravelling ★ Straight-tearing
★ Highly dielectric ★ Strong adhesion
★ Highly insulating

Serving Through Science

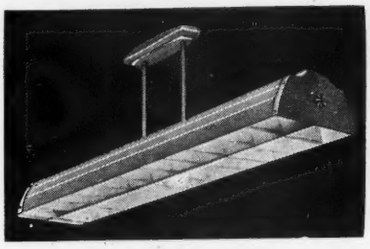
UNITED STATES RUBBER COMPANY

1230 AVENUE OF THE AMERICAS • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

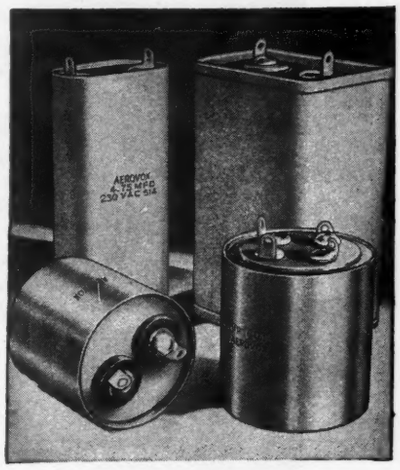
Fluorescent Fixture



CURTIS "FORTY-SIXTY"

This new aluminum fluorescent luminaire is for use in offices, school rooms, drafting rooms or laboratories. It is called "Forty-Sixty" because approximately 40 percent of its light is directed upward and 60 per cent downward. It uses two 40 watt fluorescent lamps. Dimensions are 12½-in. wide, 5½-in. deep and 48⅛-in. long. Stem hanger suspension is 12-inches, ceiling to top of body. It has Alzak aluminum reflectors and louver fins. Wiring channel and end plates are white Fluracite. Unit has aluminum reflectors, louver fins and canopy. Wiring channel, end plates and hanger stems are steel. Curtis Lighting, Inc., 6135 W. 65th Street, Chicago 38, Ill.

Capacitor



AEROVOX CAPACITOR

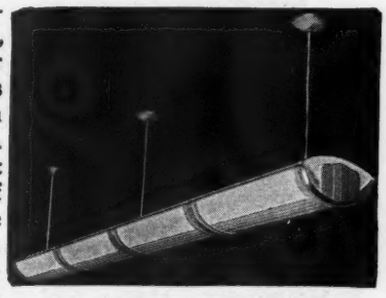
New capacitors for fluorescent lighting have been announced. Extra ruggedness has been attached in these capacitors for fluorescent lighting by a careful selection of tissue and foil, followed by thorough impregnation of sections using longer pumping cycles, it is claimed. The impregnant is Hyvol, a synthetic high-dielectric compound. Other details are the containers made of heavy steel for extra mechanical strength and plated for protection; induction-soldered cover for uniformly dependable joints; terminals treated to eliminate leakage; and the tinned lugs for easy soldering of connections. These capacitors are now available in all standard types, and also in special sizes and shapes, to suit any requirements. Aerovox Corporation, New Bedford, Mass.

Sport Floodlight

G-E FLOODLIGHT

This new sports floodlight designated as Type L-69, is adaptable for all sports field and recreation areas that require lamps of 750 to 1500 watt sizes. The front door glass is an integral part of the reflector. The forward edge of the aluminum reflector is spun over the rim of the glass, making a dirt, weather and insect proof seal. Access to the interior of the reflector and to the lamp is by unfastening two toggle latches and lifting the socket housing from the reflector. The housing can be removed without disturbing the position of the reflector, and the latches are positioned so that the socket housing cannot be improperly remounted. A blade sight is located on the reflector and a notch sight on the socket housing, to facilitate aiming the center of the beam when adjusting the floodlight for coverage of the area. A steel trunnion bracket supports the reflector, and is riveted to a malleable-iron mounting plate that includes a degree scale. General Electric Co., Schenectady 5, N. Y.

Fluorescent Fixture



WAKEFIELD FLUORESCENT UNIT

A new luminous indirect luminaire, known as Star-A, for offices, drafting rooms and schools has been announced. It uses a molded translucent Plaskon reflector of such density that the lighted luminaire is of approximately the same brightness as the illuminated ceiling. When Star units are used continuously, an evenly lighted ceiling is achieved which provides the skylike effect of evenly distributed light, with no deep shadows or sharp contrasts and without distracting glare from the light source, it is claimed. It uses 40 watt fluorescent lamps which are accessible from the top of the reflector. The F. W. Wakefield Brass Company, Vermilion, Ohio.

Don't stunt

PACEMAKER IN WIRE PRODUCTS

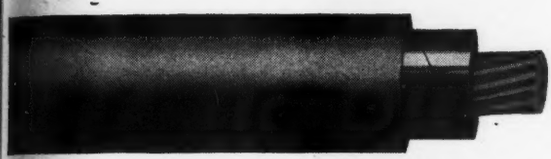
WEATHERPROOF WIRE • SERVICE ENTRANCE CABLES • RUBBER COVERED WIRES AND CABLES (INCLUDING SMALL DIAMETER BUILDING WIRES AND CABLES) • RUBBER SHEATHED PORTABLE CABLES RUBBER INSULATED POWER CABLES • MAGNET WIRE • TELEPHONE WIRES • PIGTAIL AND BRAIDED COPPER • BARE COPPER STRAND TROLLEY CONTACT WIRE • VARNISHED CAMBRIC POWER CABLES

ROE

ELECTRICAL

YOUR POWER SYSTEM'S GROWTH

Wire adequately now . . . with correct ROEBLING *cables*



VARNISHED CAMBRIC INSULATED CABLE for power, heat or lighting circuits.

PARKWAY CABLE for general power supply and distribution circuits.

RUBBER INSULATED POWER CABLE for general power and lighting purposes.

SMALL DIAMETER BUILDING WIRE for use on new or rewiring installations.

How much an industrial plant can grow depends largely on its power system. Wiring that doesn't provide for expanded production can straitjacket profits, tomorrow. And it can be costly *today* too . . . in terms of excessive voltage drop, losses in power, lowered efficiency.

Adequate Wiring calls for enough circuits, and conductors large enough, to shoulder the big loads now, and the bigger loads to come. Now—before production shoots up to higher levels—is the time to prepare for it.

Roebling electrical wires and cables can be specified with confidence in your Adequate Wiring program. From tough, protective jackets down to copper conductors drawn in Roebling's own mill, they're of top quality materials through and through. Into their manufacture go research and engineering of a high order.

And Roebling field engineers, experienced and reliable, can give you sound, helpful advice in correct cable selection—whatever the purpose, whatever the problem. They'll gladly go to work with you . . . to make *your* Adequate Wiring better than average. Just call our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

BLING

JAR ROEBLING

WIRES AND CABLES

TOUGH?

ALZAK* ALUMINUM is literally "First Cousin" to a grinding wheel!

*Registered Trademark

HIGH EFFICIENCY IN "REVERE" AIRPORT FLOODS!

Revere Electric Manufacturing Company makes wide use of Alcoa Aluminum in their 7100 Series Enclosed Type Floodlights. Alzak Aluminum specular reflectors are used for narrow beams, diffuse for wide beam types. Shell is spun aluminum, with cast aluminum neck and socket mounting.

Aluminum oxide is a tough material as abrasives go—it's used in many a grinding wheel. As reflector surfaces go, it's *exceptionally* tough—scratch-resistant, heat-resistant, an ideal protective coating for the reflective surface beneath.

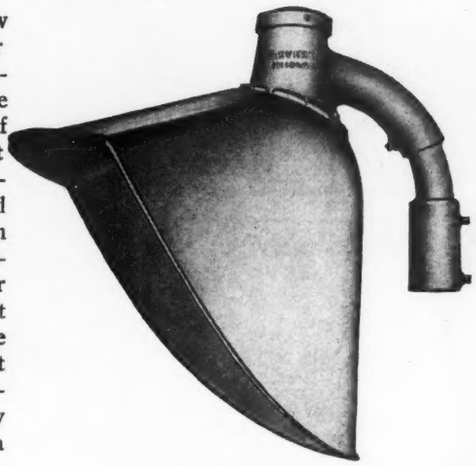
The Alzak process produces this tough protective coating on the surface of Alzak Aluminum Reflectors. That, plus the characteristics of Alcoa Aluminum itself, makes possible the high efficiency of this Alcoa product for incandescent, fluorescent, or radiant applications.

And the easy formability of Alcoa Aluminum makes it easy to carry out design ideas with a minimum of production complications and a maximum of sales appeal and all-around usefulness. ALUMINUM COMPANY OF AMERICA, 1946 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

ALCOA ALUMINUM

Triangular Floodlight

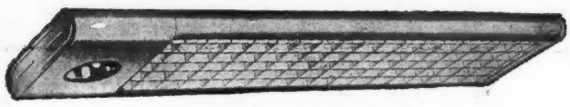


REVERE FLOODLIGHT

This new floodlight for corner locations solves the problem of cut-off. It keeps illumination confined to a given area eliminating spill over on adjacent property. The area which it covers is controlled by means of a telescoping arm which provides vertical adjustment of 37° and a total horizontal range of 360°. All wiring is enclosed. The reflector is of Alzak-finished aluminum. Revere Electric Manufacturing Company, 6029 Broadway, Chicago 40, Ill.

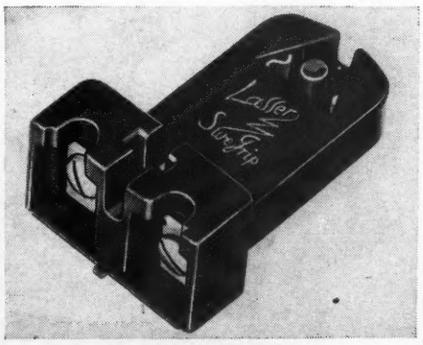
Spotlight Fixture

A new fluorescent spotlight fixture, named "Direclite", is for use in conjunction with the "Officer" line of fluorescent fixtures. It spotlights a given area of counter or floor space, and is ideal to focus attention to any particular merchandise. Fixture can be used in conjunction with any previous installation of "Officer" fluorescent fixtures. Unit is adjustable through a 50° arc. Available for two and four light fixtures. Can be installed at the end of a single unit or between units in a continuous row of "Officer" units. Leader Electric Manufacturing Corp., 6127 North Broadway, Chicago 40, Ill.



LEADER SPOTLIGHT FIXTURE

Fluorescent Lampholder



MASTERCRAFT LAMPHOLDER

A new improved Lasser sure-grip fluorescent lampholder has been announced. It features a new contact design that provides perfect, positive contact even under conditions of severe shock and vibration, it is claimed. It permits easy wiring into fixtures. Body is of durable plastic and metal insets precision stamped for uniformity. It carries Underwriters' Laboratories approval. Mastercraft Electric Co., 187 Murray St., Newark 5, N. J.

Mica-Miller

This improved mica-miller is a self contained unit operating from a 1/6 hp. Universal motor, a-c or d-c. The control switch is in the handle. The saw spindle runs at about 2800 rpm. It cuts either "U" or "V" slots. The width of the undercutter head is 2½ inches which permits use in narrow spaces. The slot guide has been eliminated. Saws and cutters are available with different angles and for various thicknesses, all in ⅞-in. diameter. The Martindale Electric Co., 1435 Hird Ave., Cleveland 7, Ohio.

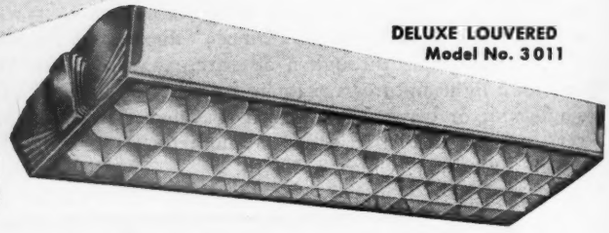
MARTINDALE MICA-MILLER

Identification Labels

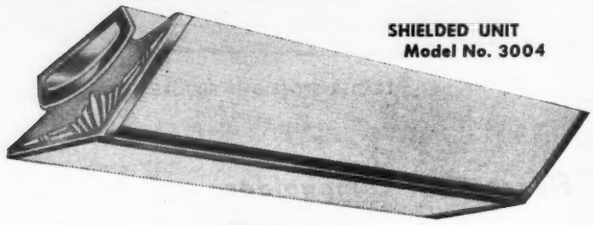
These Quik-Labels have been developed to speed up and simplify the marking and coding of wires, motor leads, harnesses, circuits, conduits, relays, coils, terminal boards, fuse blocks, cables, etc. They provide permanent legible identification, and stick without moistening to any round or flat surface. They are coated with a durable plastic which is resistant to dirt, grease, grime, oil, water, weather, fumes, gases, handling and abrasion. Pre-cut to exact size, labels come in "code-cards" ready for use. Labels are peeled from the code-card by means of a self-starter strip. The requirements of all types of electric production and maintenance problems are met by more than 400 different code-cards, including 14 varieties of color. Special code-cards can be designed to meet unusual situations. W. H. Brady Company, 2902-A E. Linwoode Avenue, Milwaukee 11, Wis.

BRADY QUIK-LABELS

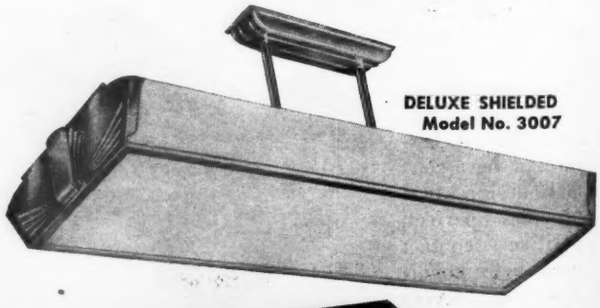
You Take the Lead in Commercial Lighting Service *with the New Complete* MITCHELL LINE



DELUXE LOUVERED
Model No. 3011



SHIELDED UNIT
Model No. 3004



DELUXE SHIELDED
Model No. 3007

With new designs, new features, in a complete line of 2-light and 4-light Luminaires . . . MITCHELL blazes the trail for you to new standards of lighting service! More than a dozen vital advantages enable you to answer every commercial lighting need. They help you provide new lighting comfort and efficiency, new style and beauty, for every type of application. Backed by nation-wide MITCHELL acceptance . . . they give you today's strongest selling line . . . turn more prospects into more sales. As a result, you achieve undisputed leadership in your market . . . you build a bigger, more successful lighting department.

Mitchell Manufacturing Company
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS
West Coast Factory and Sales Office: 1019 N. Madison Ave., Los Angeles 27, Cal.

Get New Catalog No. 285
Illustrates and describes the complete line of Commercial Luminaires. Includes helpful lighting data and servicing information. Write for it now.

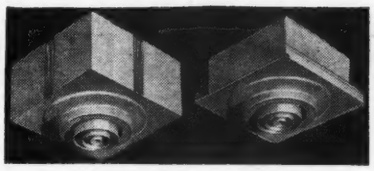
See Our Catalog in Sweet's
For convenient reference, Mitchell Commercial and Industrial units are cataloged in Sweet's 1946 Architectural and Mechanical Industries Files.

MITCHELL
FOR TOP LIGHTING VALUE

MAKERS OF

Commercial and Industrial Fluorescent Lighting Equipment • Store Window Lighting • Spotlights and Floodlights • Desk Lamps • Portable Floor and Table Lamps • Bed Lamps • Ultraviolet and Infrared Health Lamps • Residential Lighting Specialties.

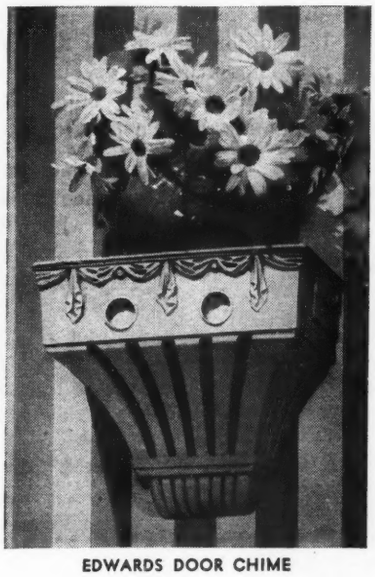
Flood or Spotlight



GUTH HY-LITERS

These new Hy-Liters provide spot or flood-lighting effects for highlighting merchandise displays and show windows. They feature easy adjustment with a 90° arc downward in all directions. The light is directed by turning and tilting the louvres to the desired direction. The 150 watt spot or flood type projector lamps used in units are shielded by concentric louvres which appear almost translucent when illuminated. They are finished in 300° white enamel and trimmed with polished aluminum fluting. Available in two styles, for surface or recessed mounting. The recessed units are available for flange or teebar installations. Fixtures have knockout and wiring channels so that they may be used as individual luminaries or mounted in continuous rows with Guth fluorescents. The Edwin F. Guth Company, 2615 Washington Avenue, St. Louis, Mo.

Door Chimes

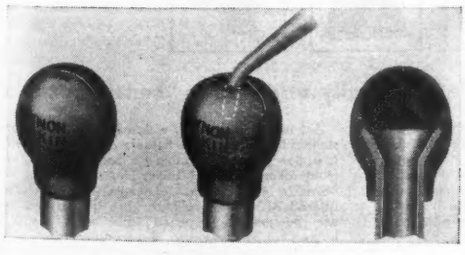


EDWARDS DOOR CHIME

This new door chime is called the "Empress Eugenie". The shelf serves an ornamental purpose—holding plant, knick-knack or clock. Finished in antique white, its design blends with any style of interior decoration and it is suitable for hall, living room or den. The chime sounds a two-note melody for the front entrance and a single one for rear door. It operates on any standard doorbell transformer or battery. Edwards and Company, Norwalk, Conn.

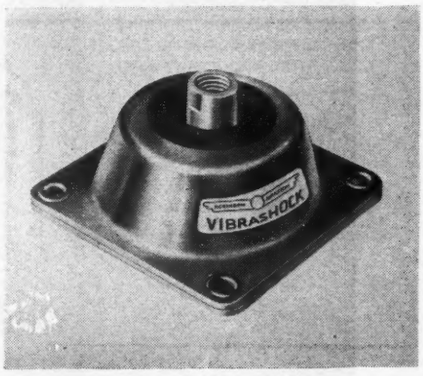
Self-Sealing Cap

A new type of self-sealing cap for oil tubes has been developed. It permits one-hand oiling from any direction. The cap is made of molded synthetic Buna "N". It is flexible and oil-resistant. The cap is applied to the flared end of an oil tube or oil line and is permanently fastened by a combination of mechanical interference fit and synthetic cement. Assembly is provided by a threaded tube end, or by a press fit into the bearing housing. The cup holds a supply of oil for slow seepage to the bearing. Dust and dirt are excluded by the tight sealing of the cap when the oil can spout is removed. The domed top design prevents collection of dirt on top of the cap. Caps are available for oil tube sizes from $\frac{1}{8}$-inch O.D. to $\frac{1}{2}$ inch O.D. Eynon-Dakin Company, 1847 West Bethune Avenue, Detroit 6, Mich.



EYNON-DAKIN CAP

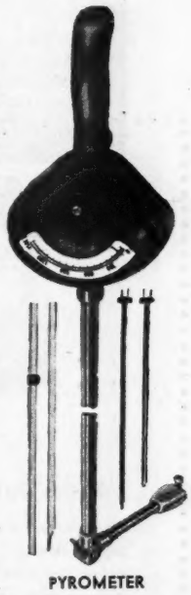
Anti-Vibration Mounting Unit



ROBINSON VIBRASHOCK UNIT

A new type of anti - vibration mounting units, for the protection of delicate equipment of all kinds, is now available for many applications in the electric, radio and electronic fields. This mount, known as the Vibrashock unit, offers a complete vibration absorption unit ready for installation and use, according to the manufacturer. A damping system, a snubbing system and electrical bonding are integral and are contained in an aluminum housing of standard dimensions. Units are available in three standard sizes and a wide range of load capacities, for electronic, radio and communications equipment, controls, relays, recorders, phonographs, regulators, motors, compresses, generators and many other installations. Robinson Aviation, Inc., Teterboro Air Terminal, Teterboro, N. J.

Instrument



PYROMETER

A new Pyro immersion pyrometer has been developed. This instrument has been especially designed for the non-ferrous industry. The design includes a $4\frac{3}{4}$ inch indicator with a 4 inch direct reading scale calibrated from 0-1500°F or 0-2500°F or equivalent Centrigrade. Two models with overall lengths of 27 and 43 inches are available both having a special designed swivel 8 inches from the connector block which permits the use of the pyrometer at any angle. The swivel is equipped with toothed notches preventing any loosening action during operation. Instrument can be used with "bare metal" and "protected" type thermocouples, both being interchangeable. The thermoelectric system is constructed with a permanent magnet, low resistance type galvanometer, has an internal automatic cold end compensator in addition to an external adjusting screw and is enclosed in a shock, moisture and dust-proofed steel case. Pyrometer Instrument Co., 103 Lafayette St., New York 13, N. Y.

When Specifications Call for.....

Aluminum covered, Weatherproof

BENCO SOCKETS

....Customer Satisfaction endures

Weatherproof

One-piece aluminum casing and retaining ring keep out dampness and moisture.

Insulated Interior

Additional safety is provided by extra heavy, heat resisting porcelain insulation.

Efficient Lamp Grip

Eliminates danger of accidental loosening of lamp due to vibration or wind action.

Easy-to-Wire

Large binding screws; one-piece interior slips out when retainer ring is unscrewed.

***Specify "BENCO" for all indoor and outdoor locations* where extra sturdiness, safety, and high insulating properties are desirable!**

Today... more and more specifications are calling for "Benco" Sockets. They are being specified in increasing numbers where requirements call for a metal clad socket specially designed to withstand the corrosive effects of outdoor weather conditions and indoor dampness. In addition, because of their sturdiness, spring type lamp grip, and excellent insulating properties they are being recommended for many other locations where dependable performance is a must.

Write for free data bulletin containing complete details on "Benco" Sockets and Porcelain Enameled Reflectors with "Benco" Threaded Necks. Sent without cost or obligation. Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

BENJAMIN

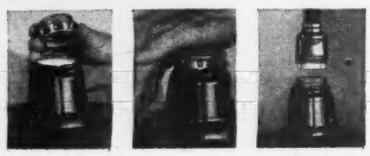
Lighting Equipment

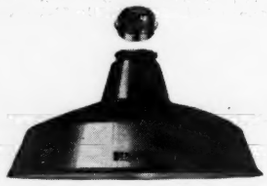
Distributed Exclusively through Electrical Wholesalers

Benco Pull Chain Sockets

Chain action completely inside the casing so that sockets are truly weatherproof. Addition of reflector or shade holder does not hamper chain action.

1713





Porcelain Enameled Reflectors Easily attached to "Benco" Sockets

Ease of reflector attachment is an important feature of "Benco" sockets. Especially are these sockets designed to provide for the quick, easy attachment of Benjamin Porcelain Enameled Steel Reflectors. Reflectors are securely attached simply by removing the threaded retaining ring located at the bottom of the socket and replacing that ring with the threaded neck of the reflector itself.

Any Benjamin reflector with a Type N Neck for standard 2¼ inch shade holders can be attached to a "Benco" socket by using the "Snap-in" Reflector Holder illustrated. RLM Domes, Shallow Domes, RLM Bowls or RLM Symmetrical Angle Reflectors are offered. All of these reflectors are, also, available with permanently attached "spun-in" "Type S" holders for attachment to "Benco" sockets.

INDUSTRIAL ELECTRIFICATION

ENGINEERING • INSTALLATION • MAINTENANCE

Selecting Industrial Control—Part II

Second in a series on the selection and application of industrial control apparatus.

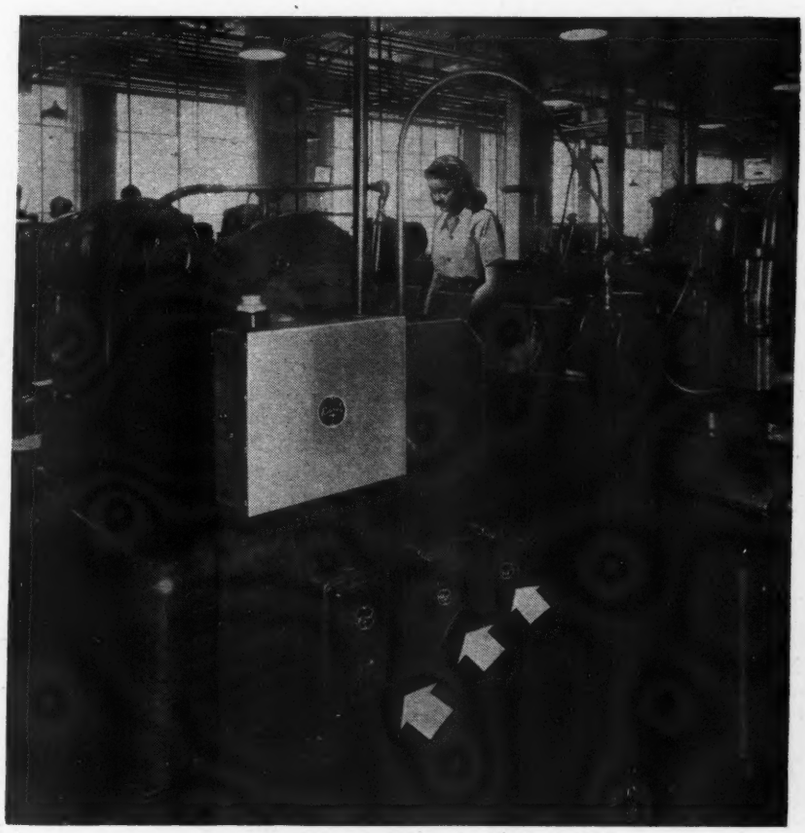
By Richard Pitt Ballou
Chief Engineer
Federal Electric Products Co.

THE National Electric Code* provides that *every motor* must be provided with a disconnecting means. This means varies with the size of the motor and the type of installation, but it must be manual. It must be manual both with respect to the OFF and the ON positions, but auxiliary magnetic operation is not necessarily prohibited.

There is a vast difference between "The Disconnecting Means" and "A Disconnect Switch". It has just been stated that every motor must be provided with a disconnecting means, and this is strictly true. For certain small motors this may be the service entrance switch. For certain small portable motors it may be the detachable plug on the end of the cord. For motors between 2 and 50 horsepower it should be a horsepower rated switch or a manually operated circuit breaker. For larger motors it may be either of these or an ampere rated switch or an isolating switch. The isolating switch may be of conventional construction and recognizable as such, or it may be well camouflaged in the form of certain types of removable fuses or an oil circuit breaker unit designed to be pulled out of its housing on trucks with the line hot.

The Disconnect Switch:

A switch which must not be pulled under load—which is to be operated only after the circuit has been interrupted by some other means—was at one time called a disconnect switch. The example most people will think of first is the knife blade type, mounted up high and operated by a hook on the end of a pole. But during the past ten or 15 years there has been a strong tendency to change the name of this type of switch to an "isolating switch", and now the term isolating switch is well established and adequately defined. But the term which it replaced is like a man without a country; it is an orphan of the transition; actually by definition



Magnetic motor starters mounted on lathe

*It is not attempted here to interpret the Code, which is frequently the subject of considerable controversy, but simply to present certain pertinent data, especially with respect to motors under 50 hp., presenting them as realistically as possible and disregarding possible minor exceptions.

Multi-breakers are made to cover wide variety of capacities and applications. Grouped here are (top —l. to r.) Type M 100-amp. service and load center assembly for a-c systems; Type MB separate-trip 9 to 16-circuit service and load center panel for home wiring; Type MB 1 to 8-circuit flush-mounted unit for same application and (directly left) Industrial flush-mounted 100-amp. unit for light and power control with surface type cover, gaskets between cover and box, NEMA semi-dust-proof enclosure and self-indicating ON-and-OFF locking handle.

there is no longer any such thing as a "disconnect switch."

But the term "disconnect switch" is used constantly, and generally without much confusion. We think of it as the switch that kills the line. In other words, it replaced the rather combersome term "The disconnecting Means" and in this capacity makes no distinction between separable plugs, switches, or circuit breakers. In this broad sense we may use the term, sometimes shortened to just "the disconnect."

If we disregard snap switches, service entrance switches, detachable plugs, and similar devices suitable for small motors, we find that there are three types of switches used as the disconnecting means: the horsepower rated switch, the general use switch, and the isolating switch.

The horsepower rated switch as used for the disconnecting means on motors of 2 to 50 horsepower and frequently on smaller motors, is capable of rupturing stalled rotor current.

The general use (ampere rated) switch used as the disconnect switch for a larger motor, such as 75 horsepower, can be pulled under load up to its ampere rated capacity, but not under stalled rotor.

The isolating switch cannot be operated even at rated load. The circuit must first be opened by some other means.

The ultimate purpose of all these switches is the same—to completely disconnect and isolate a portion of the line from the power supply. The opening of the neutral (whether insulated or grounded) is generally required whenever it is connected into the load or otherwise constitutes a part of the circuit to be isolated. The difference between the various switches, which has given rise to such varied terminology, is really in the rupturing ability, or degree of load under which the switch can be operated. This will be carried a step farther with the short circuit rupturing ability of a circuit breaker, which may also be the disconnecting means and will be discussed in detail by itself.

It should be noted that the disconnecting means is provided for the motor, not the starter. Sometimes the starter itself may serve this purpose; for example, a manual starter of conventional construction, properly fused, requires no other disconnect switch. However, practical considerations may dictate otherwise. For example, if the circuit is more than 110 volts and if fuses blow frequently, it may be undesirable to replace them with the line hot, and it may be uneconomical to shut down other circuits by pulling a feeder switch.

The requirements of disconnect switches vary somewhat with the type and their actual installation. Thus if the disconnect switch is not located within sight of the motor and controller, means must be provided for locking it in the OFF position. This should be accomplished without removing the cover. The isolating switch must be located where it is inaccessible except to qualified persons, or else provided with means for locking it in the ON position.

The Circuit Breaker:

The disconnecting means may be a circuit breaker, if manually operated. It need not be horsepower rated.

Large circuit breakers are frequently backed by isolating switches. In this case the isolating switch is really the disconnecting means so the breaker need not be manually operated.

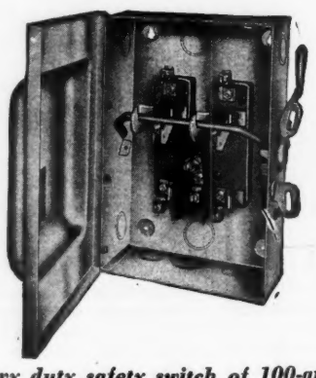
When the prescribed conditions are fulfilled, the circuit breaker may also serve as the motor starter, but it is not often a convenient arrangemnet.

The use of the isolating switch ahead of the circuit breaker is to permit inspection or adjustment of the latter. Since such maintenance is always necessary on large primary breakers, (and usually desirable on all others) the general statement may be made that every breaker is backed up by some other circuit opening device.

The service entrance breaker is sometimes isolated by a regular isolating switch, by removable fuses, or by pulling the breaker itself out of its cubicle (when designed for such removal).

Distribution or sub-feeder breakers are backed by the service entrance switch or disconnecting means, while the breakers on motor branch circuits have at least the service entrance and probably other disconnceting means ahead of them.

Thus the use of an isolating switch directly ahead of a breaker is actually necessary only when a disconnecting means is required at that point and the breaker is not manually operable. How-



Heavy duty safety switch of 100-amp. capacity

ever, in actual practice the isolating switch is likely to be provided with all except small air breakers because of the convenience it affords at a relatively low cost.

In general, small hand operated air circuit breakers on motor branch circuits constitute satisfactory disconnecting means with respect to practical as well as Code requirements, with only such backing as the normal distribution plan of the building provides. In this capacity it successfully replaces the fused disconnect switch for branch circuit protection, although at a higher initial cost. This may soon be offset by the saving in fuses and replacement time, if shorts are frequent. The circuit breaker may be enclosed in the same housing with the starter. Disconnecting means are also available as a part of reversing and multi-speed starters.

The trip unit on a circuit breaker may be thermal or magnetic. Small thermal breakers operate sufficiently fast on short circuits but the larger ones usually incorporate also a magnetic trip unit (sometimes called "instantaneous") set for seven to 14 times the thermal rating.

Breaker Operation

Fuses and breakers function quite differently. With a fuse, the greater the current the quicker the fuse opens the circuit. With a breaker this is true over the range of the thermal unit; but when the current is high enough to operate the magnetic unit the speed of opening is fairly constant (except to the extent that the arc may persist slightly longer with higher currents). Motor starter overload relay heaters which are tested not to burn out on a circuit of 5000 amperes capacity, with fuses not over four times the full load motor current, may operate in a circuit which is more favorable, or less favorable, if a circuit breaker is substituted for the fused switch. Usually the conditions are considered sufficiently similar so that no particular consideration need be given to the use of the breaker.

In the actual selection of the circuit breaker size the control manufacturer's recommendations should be followed. The following will indicate about what may be expected:

With a thermal of thermo-magnetic breaker, a rating of about twice full load motor current.

With a magnetic breaker with dashpot or other type of time delay device, a rating of from slightly more to several times full load motor current.

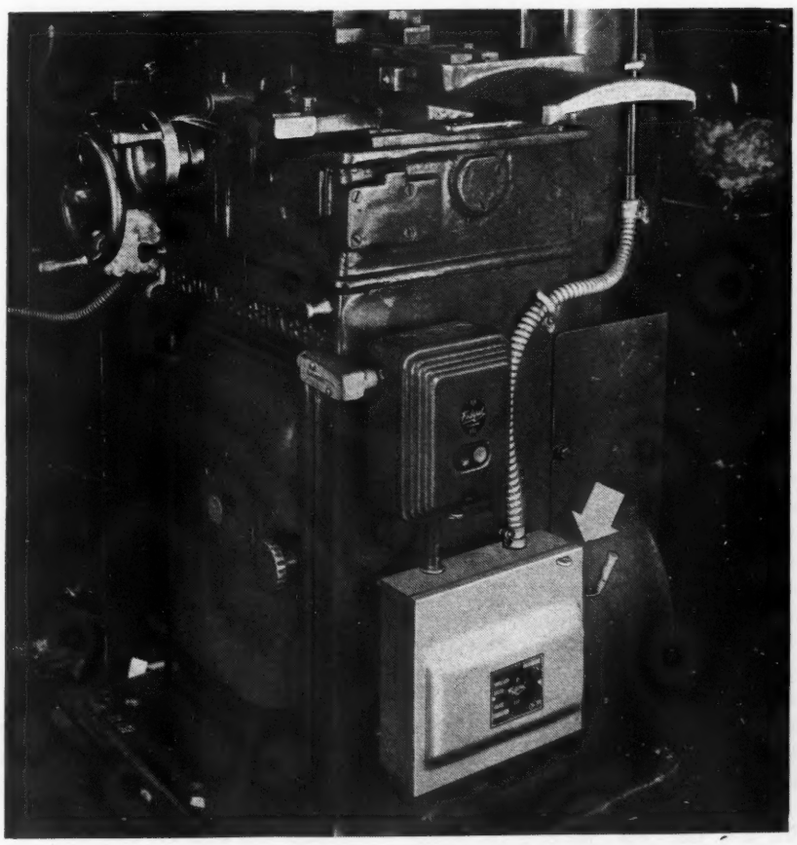
With a straight magnetic breaker a setting of about seven times full load motor current, or enough to keep it from tripping when starting the motor, according to the code letter indicating the locked rotor kva. (See the National Electrical Code for values.)

When the circuit has a short circuit capacity in excess of the rupturing ability of fuses it is necessary to limit the possible current (as by chokes) or use circuit breakers. The larger breakers are rated both in terms of their carrying capacity and their rupturing capacity; thus a 600 ampere breaker may have a rupturing rating of 40,000 amperes.

Fuses and the smaller air circuit breakers are both tested on circuits having a 10,000 ampere short circuit capacity. A safety factor of two would indicate their satisfactory use on circuits up to 5,000 amperes capacity. This is the capacity of the circuit on which most standard motor starters and overload relays are tested, and either fuses or circuit breakers are obviously satisfactory with these starters.

When the short circuit capacity of the line exceeds 5,000 amperes it is evident that a standard starter would be insufficient even though it were backed by a circuit breaker of high rupturing capacity. A special starter would be required in addition to the high capacity breaker*. While such heavy circuits are not generally recommended they are being found in increasing numbers, particularly in large industries, such as those built during the recent war, and in which the operating potential is 440 or 550 volts. It is generally preferable to install current limiting reactors than to attempt to use motor starters designed to withstand the heavier curent, because the latter are both expensive and difficult to obtain.

* Sometimes a standard starter can be used by locating it in a vault or other place where its failure would not constitute a hazard to personnel or property. The usual method by which a starter may fail dangerously is this: The excessive current melts a heater, or the contacts, and produces a highly ionized condition within the enclosure, resulting in a phase-to-phase short circuit. The energy then dissipated within the enclosure is so great that it ruptures the enclosure and the device literally "explodes". Even though the heaters or contacts melt, a short may not occur within the device, and if it does the circuit breaker may clear the line before enough energy has been dissipated with the enclosure to build up a dangerous pressure. However, on high capacity lines the ultimate possibilities should be guarded against since the explosion can be one of considerable violence.



Safety switch and magnetic starter installed on grinder.

Flush mounted multi-breaker for home use

It is a mistaken idea that if a size No. 1 starter is required for the motor, the high capacity line can be taken care of by installing a size No. 2 or No. 3 starter. This is not true; all these starters are designed for and tested on the 5000 ampere line. The smallest possible starter should be used, in accordance with the manufacturers' ratings. Leave the safety factor to the manufacturer and the Underwriters' Laboratories, Inc. This will save both space and dollars. Also, a small starter generally has a considerably longer mechanical life than a large one.

The Disconnect as a Motor Starter:

Certain small motors for domestic use, such as clocks, electric razors, and ice cream freezers are frequently furnished with no starting switch at all; the attachment plug on the end of the cord then serves both as a disconnect and a motor starter.

In the case of larger and non-portable motors a different type of disconnect will be provided, but it may still serve as the motor starter if it is a horsepower rated switch or a circuit breaker. Overload protection must be provided in accordance with the Code, but not necessarily as a part of the motor starter.

For years many motors were started by fused knife switches. Overcurrent protection was supposedly provided by the fuses, but in actual practice the starting time of the motor was likely to require fuses too large to really protect it in event of an overload. Sometimes, with a-c, use was made of a double throw switch that shorted out the fuses during the starting period. While these methods are still acceptable to the Code (with the proper size fuses) they are of little practical application.

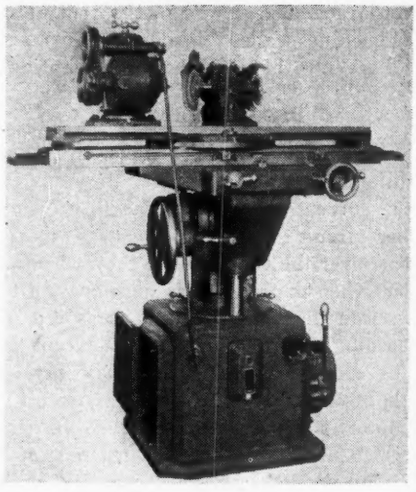
A fused manual starter is inexpensive and convenient, meets Code requirements and needs no other disconnect. However, most manual starters are used in conventional circuits with a regular disconnect switch (fused "safety switch") ahead of the starter. This makes it unnecessary to change fuses on a hot circuit, and kills the entire line, including starter, for inspection or adjustment. As a matter of fact most manual starters are likely to have the contacts weld on a heavy short circuit, even when properly fused, and may need to be reconditioned before service is re-established. If the starter works on a toggle, depending on a spring for its ON and OFF positions, it is even less suited for disconnect service.

Integral overload protection:

Sometimes overload protection is provided as a part of the disconnect switch instead of the motor starter. Typical illustrations are oil burners, stokers, pumps, air conditioning units, etc. where the motor is operated by two controls: one, the disconnect, serves to put the equipment into service and to take it out at the end of the day or required operating period; the other, an automatic device such as a float switch, pressure switch, or thermostat, controls the operating cycle of the motor and may not lend itself conveniently to overload protection. In such cases the overload protection can be added as a separate unit, or may be built in as a part of the motor, or may be included in the disconnect switch. Separate protection is generally the least economical in small installations; an inherent overheating device as a part of the motor is economical and convenient on single phase motors if the motor is easily accessible or the overload device can be automatic resetting. For larger and especially for polyphase motors, the manual starter with overload protection, if it is designed to also meet the requirements of a disconnect switch, is very practical.

If the disconnecting means is a circuit breaker it may also serve as a motor starter. Large breakers are quite expensive, and suitable overload protection may be added at relatively small increase in cost. With smaller breakers this is not true and the setting of the overload trip unit (if adjustable at all) is generally not in small enough increments to provide adequate motor overload protection except in chance cases.

It may, or may not, be economical to use the large circuit breaker as a motor starter. Certain installations requiring the infrequent operation of a large motor may need nothing more than the hand operated circuit breaker. In other cases the breaker may be magnetically operated and backed by an isolating switch. In general a starter which is operated frequently should be other than the circuit breaker. This is obvious since if a fault should develop during its operation as a starter it would very likely interfere with its satisfactory operation as a breaker, in which case some other circuit rupturing means would be required ahead of it. There are some cases where this is a desirable arrangement, but it should be noted that an ordinary motor starter backed by a relatively inexpensive manually operated circuit breaker is likely to be lower in initial cost and upkeep than a magnetically operated circuit breaker with overload protection, even when backed by only an isolating switch. There are many factors involved—one, previously mentioned, being the short circuit capacity of the line. Since these factors concern engineering requirements, first cost and operating economies, expansion possibilities, and continuity of service, they should not be settled hastily. Manufacturing data concerning application and operation should be considered. It is recommended that important expansions or installations be carefully reviewed for all of the above factors by a competent control engineer working in conjunction with the plant electrician and superintendent.



Small lathe with manual starter.

Century Type SCT Form J motors operating punch presses — a heavy shock load application.

PROLONG EQUIPMENT LIFE•

By Reducing the Impact of Shock Loads... with CENTURY High Torque, High Slip Motors

Century high torque, high slip, industrial motors (type SCT) are made for such applications as punch presses and shearing machines — where there is a sudden load impact in the operating cycle. These motors help to cushion this shock because the motor speed is pulled down as the peak load comes on.

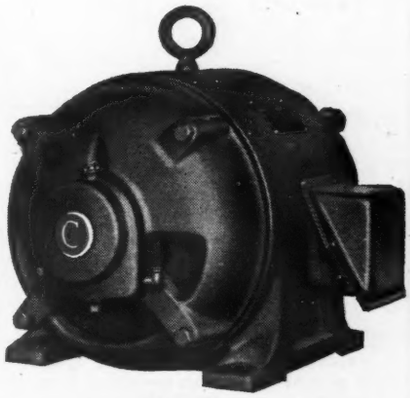
As this peak load is reached the machine operates from the energy stored in the flywheel. Then the motor picks up speed again, and stores up energy in the flywheel for the next cycle.

Century high torque, high slip motors are particularly adaptable to applications where the length of the cycle gives time for slowing down and speeding up.

This saves wear and tear on equipment, reduces maintenance costs, saves on tools, dies, or shearing blades.

Specify Century motors on all your electrically powered equipment. Engineered to the functional characteristics of the machines they drive to assure top performance — Century motors are a vital factor in producing a better product at a lower cost.

Century motors are built in many types and sizes from 1/20 to 600 horsepower.



Century C MOTORS

455

CENTURY ELECTRIC COMPANY

1806 Pine Street · St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

D-C Control Circuits—III

C-8

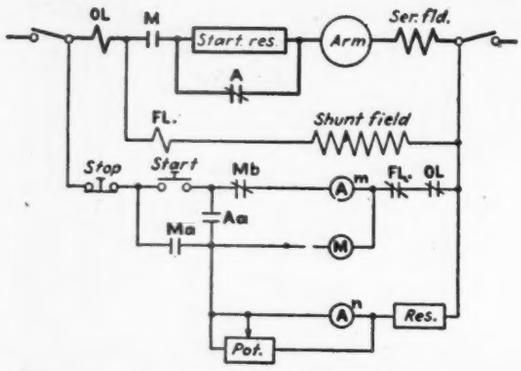


FIG. 9—Connections of field loss relay, to prevent excessive speed if the shunt field is deenergized while voltage remains on the armature.

It usually consists of a current relay in series with the motor shunt field and is adjusted to pick up on full-field current and remain closed at any current within the operating range of the motor field current. Contacts of relay *FL* are connected in series with the overload relay contacts so that the opening of its contacts will deenergize the control by opening the line contactor. This type of field loss protection does not protect against the possibility of a short circuit across a part of the field, say across the one field coil. This would cause the motor speed to rise considerably but the current in the field circuit would also rise. Consequently, the series current relay would not respond.

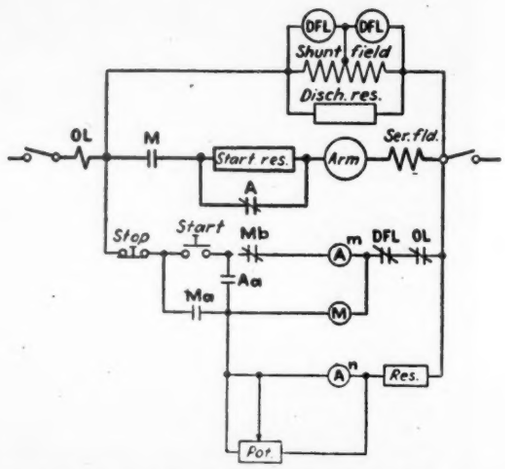


FIG. 10—Application of differential field loss protection.

The differential field loss relay *DFL* is equipped with two voltage coils connected to buck each other. Each is connected across one-half of the field winding. Normally the voltage across each coil is the same, hence the relay stays in the outposition with its normally closed contacts closed. Shorting out of one field coil or other failure causing an unbalance of these voltages causes the relay to pick up, opening its contacts and dropping out the line contactor, deenergizing the motor.

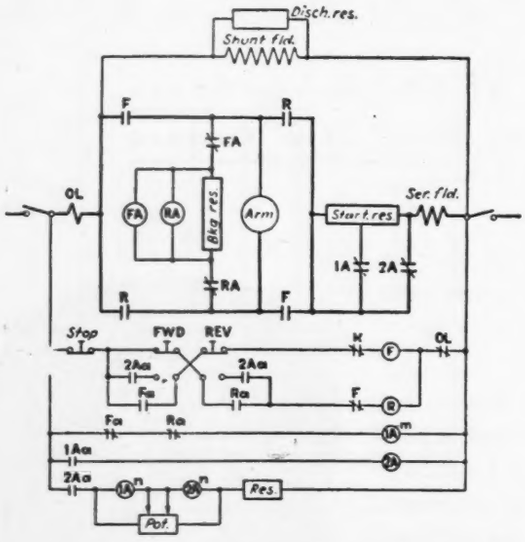


FIG. 11—One form of reversing dynamic braking control, consisting of multi-pole contactors having two poles normally open and one pole normally closed. Acceleration contactors *1A* and *2A* are energized in the off position, as in Figure 6. Depressing the forward button energizes forward contactor *F*, closing the two normally open contacts *F* and opening the normally closed contact *FA*. Opening of normally closed auxiliary contact *Fa* starts the timing cycle of the accelerating contactors. Closing of the normally open auxiliary contact *Fa* establishes a holding circuit. When the stop or reverse button is depressed contactor *F* drops out, closing normally closed contact *FA* and setting up a dynamic braking circuit through the braking resistors, which energizes coils *FA* and *RA*. These coils hold the normally closed contact closed, and the normally open contacts open until the braking current drops to a low value. This action prevents bouncing of the back contacts and plugging the motor, because if the reverse button were depressed during the braking period contactor coil *R* would not have sufficient strength to overcome the pull of the *RA* coil until the motor had almost stopped.

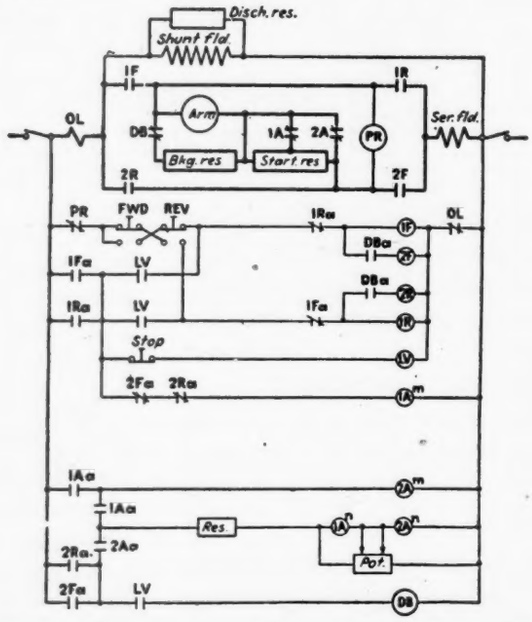


FIG. 12—Another form of reversing dynamic braking starter using a spring-closed dynamic braking contactor and single-pole normally open directional contactors. When start button is depressed contactor *IF* is energized. Closing the normally open auxiliary contact *IFa* energizes relay *LV* to establish a holding circuit and also energizes accelerating contact *1A*; *1A* contactor energizes *2A*, and *2A* energizes *DB*. In turn, *DBa* energizes *2F* and normally closed contact *2Fa* starts the accelerating timing.

Depressing the stop button drops out *LV*, closing *DB* immediately. Plugging is prevented by relay *PR*, a voltage relay connected across the motor armature. Its normally closed contacts remain open, preventing the pick up of the reverse directional contacts until the armature speed drops down to a safe value for plugging.

*Data from Westinghouse Electric & Mfg. Co.

SEE FAIRBANKS-MORSE FIRST FOR MOTORS

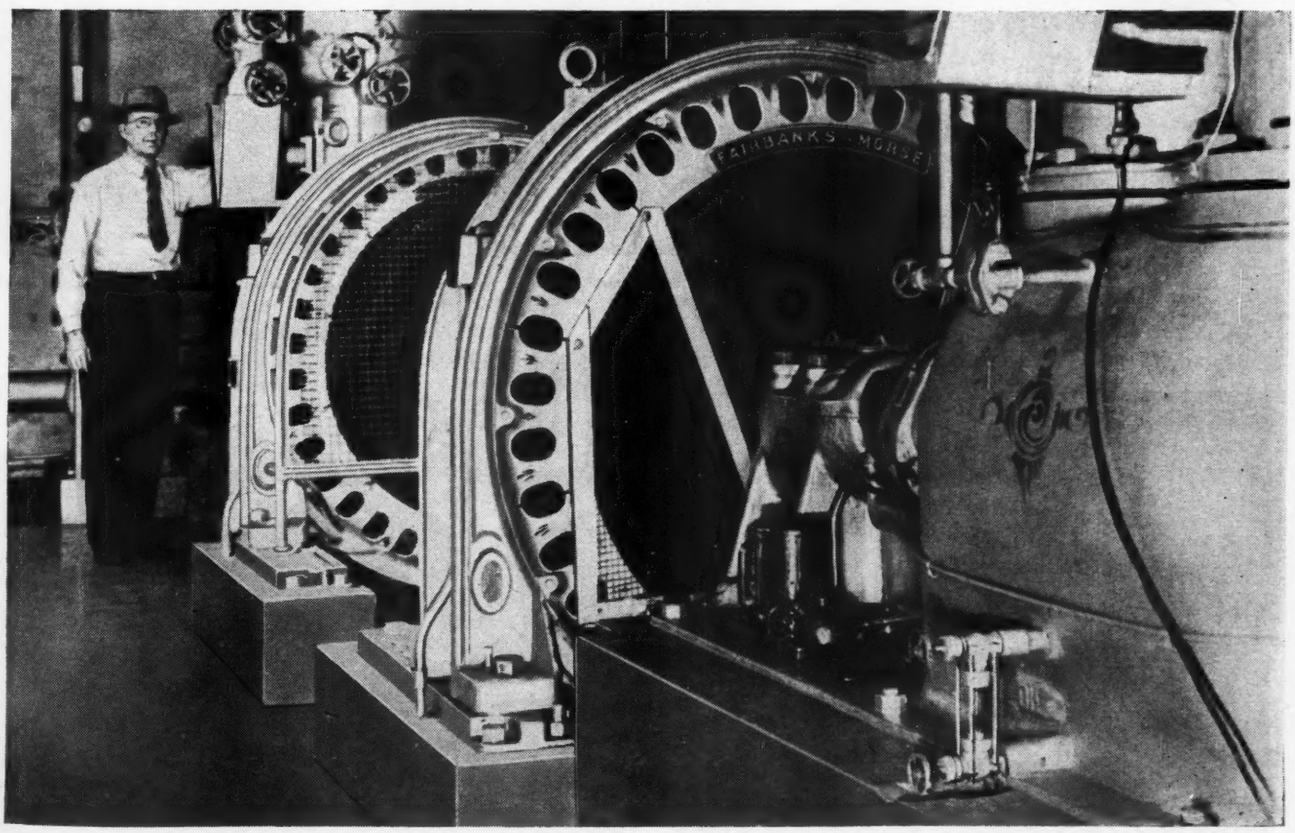
IMPROVED plant operation is something you can count on when you use Fairbanks-Morse *Synchronous* Motors.

These dependable units assure a better plant power factor, constant speed operation over entire load ranges, and truly economical service. Designed with modified torque characteristics, they can be adapted to a wide variety of applications.

Available in a full range of high and low-speed types, these motors are part of a full line of Fairbanks-Morse Motors and Generators now serving industry with performance-boosting economy. Write for details today.

Fairbanks, Morse & Co., Chicago 5, Illinois.

Fairbanks-Morse synchronous motors driving compressors



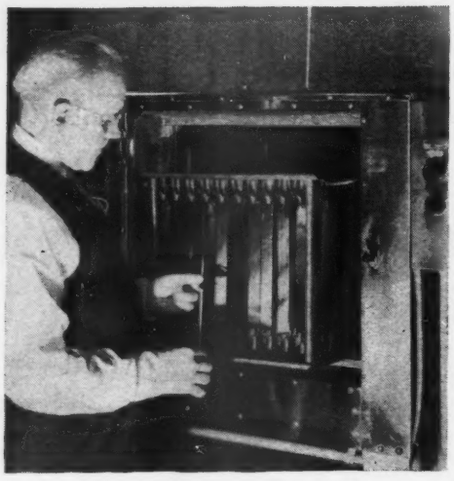
Fairbanks-Morse

A name worth remembering

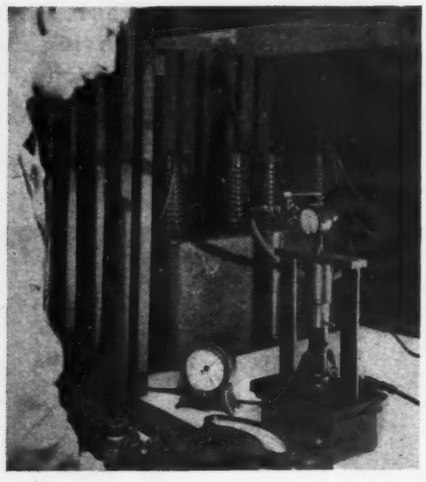
Diesel Locomotives • Diesel Engines
Scales • Motors • Pumps • Generators
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

If you need greater power capacity but have limited space . . .

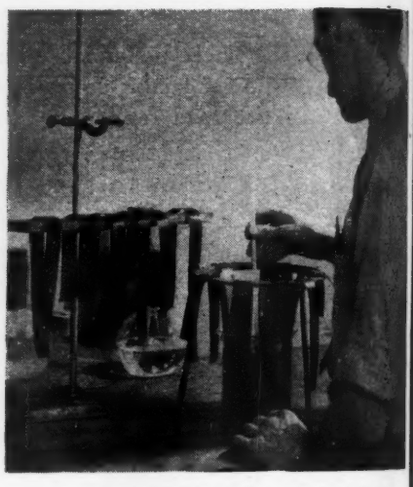
Use these improved U·S·S American Varnished



Greater heat resistance. Precisely controlled ovens subject varnished cambric to aging tests far in excess of normal requirements.

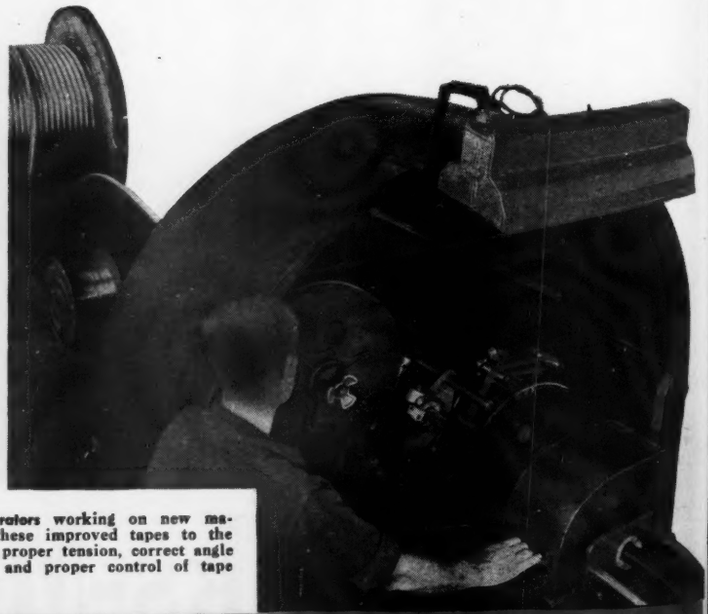


Dielectric strength tests are run on samples from each lot under carefully controlled conditions.



Hot oil and other solvents have little effect on varnished cambric.

Tearing strength, gauge and thread count are determined to maintain high standards of quality.

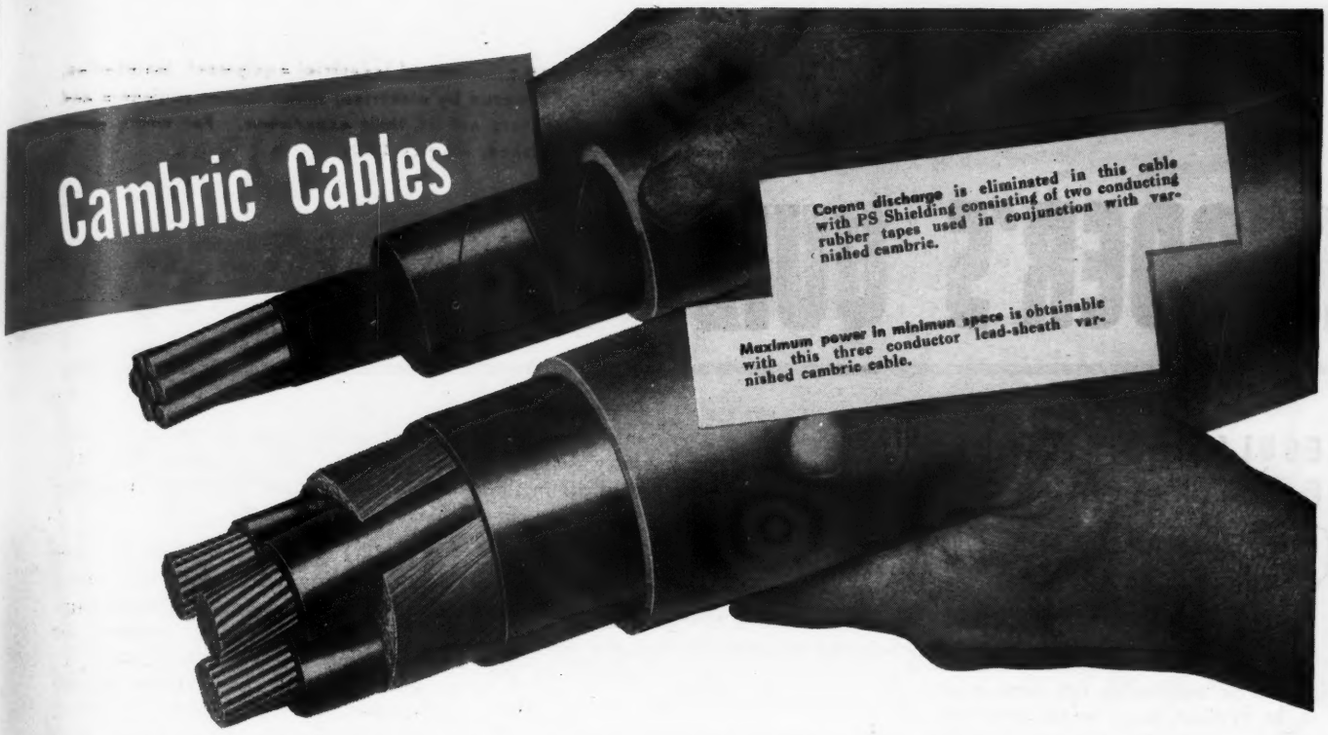


Experienced operators working on new machines apply these improved tapes to the cable assuring proper tension, correct angle of application and proper control of tape position.

Types of Varnished Cambric Cables

- Single-conductor series street lighting cables.
- Multiple-conductor non-leaded and unarmored cables.
- Control cables with combination of different colored braids.
- Single-conductor lead-sheathed cables.
- Single-conductor non-leaded cables.
- Multiple-conductor lead-sheathed or metallic-armored cables.

Cambric Cables


Corona discharge is eliminated in this cable with PS Shielding consisting of two conducting rubber tapes used in conjunction with varnished cambric.
Maximum power in minimum space is obtainable with this three conductor lead-sheath varnished cambric cable.

ENGINEERS who are faced with increasing the capacity of their power lines but are limited by conduit size will get help from the improved U·S·S Varnished Cambric Cables.

Higher operating temperatures can be used as the improved varnished cambric will stand temperatures up to 85°C. In this respect it is notably superior to rubber. It is also superior in dielectric strength so that thinner walls of varnished cambric insulation can be used for a given voltage.

These two advantages often make it possible to obtain the increased power capacity without ripping out the old conduits which is a costly undertaking.

Varnished Cambric Cable may be obtained with over-all braids, lead sheath, or Ampyrol synthetic resin non-metallic jackets. Type PS Shielding employing non-metallic conducting tapes over the conductors and over the insulation offers improved high-voltage operation.

Another important advantage is that they are not injured by oil, grease, or corona so they can be used around all types of machinery without danger of disintegration.

Write for the latest information on U·S·S American Varnished Cambric Cables. Great improvements have been made during the war and they may be just what you need for new layouts or re-wiring your old systems.

American Steel & Wire Company

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

Where to use U·S·S American Varnished Cambric Cables

IN MODERATE OR LOW-VOLTAGE INSTALLATIONS where its superior heat resistance permits greater current carrying capacity for a given copper area.

IN POWER PLANTS for general wiring and such applications as insulated bus bars, motor and generator leads, connections for oil switches, transformers and voltage regulators.

IN INDUSTRIAL PLANTS, especially where heavy loads must be transmitted for short distances.

AMERICAN STEEL & WIRE COMPANY · USS · AMERICAN ELECTRICAL WIRE AND CABLE · UNITED STATES STEEL

U·S·S American Varnished Cambric Cables

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

READER'S QUIZ

REGULATING VOLTAGE OF GENERATOR

QUESTION 214 — Some Tyrill voltage regulators which we use to control the excitation on our alternators have after many years of faithful service, reached the point where they must be replaced.

The suggestion has been made to replace these regulators with tube control possibly an adaptation of the Thymotrol circuit as used to control the speed of a d-c. shunt wound motor.

Each machine is rated at 750 kva., 2300 volt, 60 cycle, and is direct driven from an 850 h.p., 4000 volt., 25 cycle motor with 120 volt exciter mounted on the same shaft. D-c. amperage varies from 20–23 amps. and the load is fairly constant.

Can any reader inform me if this is sound practice and how it can be accomplished?—A.R.

A. TO QUESTION 214—The idea of regulating the voltage of a generator by electronic means is entirely practical, and has been proven at the plant where the writer is employed by several units which have been in satisfactory operation for about one year.

The theory of the installation is simple; however, it took quite a bit of experimentation to work out the practical application. Basically, the system as applied to an a-c generator is as follows: The field of the exciter is supplied with its d-c from an a-c line through a pair of Thyratrons whose firing point, and consequently the average d-c voltage supplied to the field, is controlled by a phase shifting circuit, which is in turn controlled by a pilot voltage taken from the a-c line to be regulated. Correction is practically instantaneous due to the fact that no moving parts are involved.

We first applied this system to a d-c generator of about 200 kw., when, due to a change in processing specifications, it became necessary to operate this machine at about ⅓ of its rated voltage. When the load was switched on or off, in blocks of about 50 kw., it was impossible to see any movement at all in the voltmeter needle. This installation, intended as temporary, has been in use over a year with a total of 15 minutes down time due to the failure of one of the small control tubes. The only modifications necessary to apply the system to a-c would be a minor change in the control circuit.—W.B.S.

A. TO QUESTION 214—It is advisable on condition that you will care to keep on hand some spare parts. Voltage regulation will improve, and maintenance expense will be reduced. Due to patents on electronic parts and circuits, it is best to buy a manufactured regulator, and follow the manufacturer's instructions.—H.S.

SHADING COILS

QUESTION 215—I wish to rewind several single phase magnet coils for a lower voltage. As the flux in the magnetic circuit will remain approximately the same, is it necessary to increase the area of the shading coils?—T.B.

A. TO QUESTION 215—It will not be necessary to increase the area of the shading coil. The action of the shading coil is, of course, to cause that part of the flux flowing through it to lag the main flux and thereby prevent chatter. This action with the same flux will not change since the magnetic circuit is also unchanged.—C.P.S.

A. TO QUESTION 215 — Your problem is merely one of ampere-turns. If the volt ampere burden is the same with the new coil, the magnet should perform equally as well. The shading coil would have the same induced current.—E.J.K.

A. TO QUESTION 215 — Inasmuch as the total flux in the magnetic circuit will remain approximately the same, the voltage induced and current flowing in the shading coils will remain the same as before the voltage change. The shading coils can therefore be used without change.—R.G.C.

A. TO QUESTION 215—To have the original strength, when operated at a lower voltage, the Electro-magnet must be rewound to produce the original flux density in the core.

In this case, the same number of lines of force will thread through the shading coil and induce the same current in it as before.

Since there will be no change in induced current, the original shading coil can be used.—B.A.S.

THERMOSTATS

QUESTION 216—Can thermostats be used to cause an alarm, before hay starts burning due to spontaneous combustion?—H.S.

A. TO QUESTION 216—There is no reason why thermostats could not be used to sound an alarm before spontaneous combustion takes place in hay.

My first move in planning this alarm system would be to write to the experimental department of some college, such as Cornell University, and learn at what temperature hay will ignite due to spontaneous combustion since different materials ignite at different temperatures. This would have to be known to know what range the thermostat should be.

I would then choose thermostats that are completely closed around the movable element to prevent hay from entering the case which might destroy the action of the thermostat. The closed case would also prevent trouble due to arcing at the contact points.

Thermostats with long capillary tubes could be used in which case the contact points could be located outside of the hay region.

All thermostats would be connected in parallel and close a low voltage circuit to a bell or to a relay. The relay in turn could close a bell circuit of standard voltage.

HERE ARE THE BEST YOU CAN BUY..

ACE SHOP EQUIPMENT

... Ace High In Service!

Fast, flexible, rugged, heavy duty Ace Equipment is adaptable to every type of job, from fractional sizes up to 100 H.P., quickly and easily.

Powerful *ACE WINDERS* will pull the heaviest wire for the largest coils in their range — have life-time non-grab, positive clutch control — gear and belt drives engineered to eliminate chatter — and will take all types of winding heads.

Sturdy *ACE COIL FORMERS AND SPREADERS* stand up under severest service — are smooth and positive in action.

Built to last a lifetime, an investment in Ace Shop Equipment pays dividends every year in satisfaction and profit. Shipment is prompt — from factory stocks.

Write for Ace's New Illustrated Catalog

MACALLEN MICA

... It Has What It Takes!

MACALLEN MICA is the universal choice in every shop doing quality, guaranteed motor service work. *MACALLEN MICA* has the highest dielectric strength of all easily worked insulation materials and is unaffected by heat.

Manufactured under exacting production controls to insure perfect accuracy, *MACALLEN MICA* is furnished in sheets in all thicknesses and sizes for moulding and cold forming, segments, and in every other form required for all shop needs.

Use *MACALLEN MICA* for your best jobs.

Samples and Prices Sent on Request

PEDIGREE INSULATING VARNISHES

... The Product with a Pedigree!

Every *PEDIGREE VARNISH* sold has been tested and service-proved by some of the world's largest electrical manufacturers. *PEDIGREE* means the best in the field — impregnating varnishes — varnishes for baking or drying — finishing varnishes — protective sealers — sticking varnishes — insulating compounds — machinery enamels.

Whether you need protection against oil, acid, alkali or moisture — protection against heat — maximum insulating qualities — tough and flexible coatings — *PEDIGREE* provides the ***right*** product to do the job ***right!***

Insist on *PEDIGREE VARNISHES* — guaranteed to satisfy or your money back. You won't get the best unless you say *"PEDIGREE."*

Send for Application Chart, Catalog and Samples

INSULATION AND WIRES INCORPORATED

2127 PINE ST. • ST. LOUIS 3, MISSOURI

BOSTON 20, MASS. DETROIT 2, MICH. ATLANTA 3, GA.
HOUSTON 2, TEX. NEW YORK 7, N. Y.

Send for Your Copy of the IWI Blue Catalog.

DEPEND ON—INSIST ON—

P. R. MALLORY & CO., Inc.

MALLORY CAPACITORS

Mallory MSG Capacitor:—Small, compact AC Motor Starting Capacitor that fits almost every mounting bracket or box. Replaces rectangular capacitors with leads, lugs or studs. Each capacitor is packed with complete set of universal mounting hardware and installation instructions.

Necessary leads, lugs, screws, and nuts are included in each box for any type connectors.

Mallory Type "P" Capacitor:—Plastic case overcomes moisture absorption problems, and provides maximum insulation. May be used to replace cardboard insulated aluminum-case capacitors. Splash-proof plastic end cap and simplified "snap on" mounting bracket available when capacitor is used as original equipment.

Distributed by

INSULATION AND WIRES INCORPORATED

SAINT LOUIS 3, MISSOURI

BOSTON 20, MASS. DETROIT 2, MICH. ATLANTA 3, GA.
HOUSTON 2, TEX. BLUEFIELD, W. VA. NEW YORK 7, N. Y.

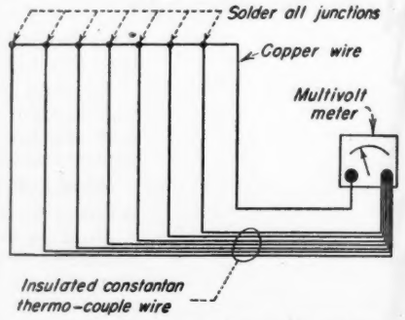
SITTLER COMPANY
CHICAGO 7, ILL.

H. A. HOLDEN, INC.
MINNEAPOLIS 3, MINN.

TRI-STATE SUPPLY CORPORATION
LOS ANGELES 13, CAL. • SAN FRANCISCO 7, CAL. • SEATTLE 4, WASH.

However, I think a safer, cheaper and more satisfactory system would be to use a network of thermo-couples using one copper wire and as many branches of Constantan thermo-couple wire as desired. With this system there would be no chance of a short circuit or arcing of any kind which is a possibility in the wiring to thermostats. The hook-up would appear as shown in the sketch. The various branches of Constantan wire (about 24 gauge) are twisted around the copper wire and soldered.

The loose end of the copper wire is shown run to one terminal of a milli-volt meter and the loose ends of the Constantan wires are all run to the other terminal of a milli-volt meter.



As the hay heats, near the points of junction of copper and Constantan wires, a very small voltage is generated which is indicated on the meter.

A chart, RP1080, can be obtained from the Bureau of Standards, Washington, D. C., by which the reading of the milli-volt meter can be converted to temperature. Direct reading temperature instruments can be obtained but are very expensive and no more satisfactory.

By periodically reading the meter, one could detect long before the danger point is being reached whether or not heating is taking place. By removing a few Constantan wires at a time from the meter terminal, one could trace the wires most affected to the region in danger. As many networks as desired can be used in the stratas of hay and all run to the same meter.—B.A.S.

A. TO QUESTION 216—I do not know of any system such as you suggest being in use at present, but its design would be a very simple matter from the electrical standpoint.

The chief difficulties would be mechanical as each thermostat would have to be wired to some point outside, and these wires would cause considerable trouble and be liable to damage when the hay was removed.

I would suggest mounting the thermal units in the ends of small pipes, (say ½ in.) with sharp points, and bringing the connecting wires out the other end. After the hay was in, these pipes could be driven to the required depth and the wires connected at the top. If necessary,

WAGNER Repulsion-Start Induction Motors Are Long-Lived, Economical, and Dependable

Wagner type RA repulsion-start induction motors give years of reliable, trouble-free service, because dependability is built into every motor.

Careful engineering has reduced wear, vibration, and noise of operation to a minimum. Many important construction features such as sturdy welded steel frames and well-insulated windings securely held in place, add to the ruggedness of the motors without sacrificing compactness or efficiency.

Wagner type RA motors embody all the important improvements in single-phase motor design. This means that the user of RA motors gets the best motors for the job with long life and dependability built into every part.

Type RA motors are available in ⅛ to 15 hp; sleeve or ball-bearing; horizontal or vertical; open, drip-proof, and totally enclosed; rigid, resilient, or flange mountings.

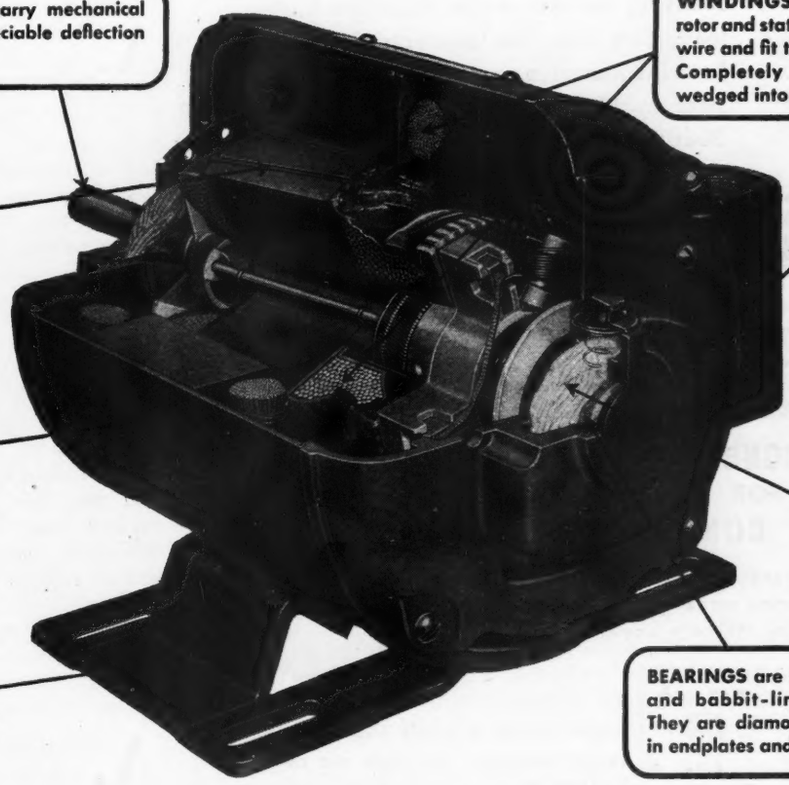
A few of the many Wagner construction features are shown below around a cut-away view of the type RA. For complete description of Type RA motors, write for Bulletin MU-185, and address your inquiry to Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.

SHAFT is designed to carry mechanical overloads without appreciable deflection or vibration.

SLOTS in rotor are skewed to reduce magnetic noise and variation in starting-torque.

FRAME—Motor frame is formed from heavy sheet steel. Electrically welded to form a strong, rigid frame which withstands a considerable amount of abuse.

BASE is punched and formed from steel plate—unbreakable. Mounting slots permit shifting of motor for belt tightening.



WINDINGS—The windings of both rotor and stator are of heavily-insulated wire and fit the slots without crowding. Completely insulated and securely wedged into place.

ENDPLATES are concentrically machined and closely fit machined frames, assuring accurate centering of rotor and uniform airgap.

LUBRICATION—Long-strand wool yarn is used in all fractional-horsepower motors. Oil-wells are roomy and the yarn supplies plenty of oil, assuring adequate lubrication at all times.

BEARINGS are steel-backed for strength and babbit-lined to minimize wear. They are diamond bored after assembly in endplates and have a mirror-like finish.

M46-12

Consult Wagner Engineers on all Electric Motor Problems

Electric Motors • Air Brakes • Brake Lining Hydraulic Brakes

Wagner

Transformers • Industrial Braking Systems NoRoL • Tachograph

Sales and Service Branches: ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 • CINCINNATI 10 • CLEVELAND 15 • DALLAS 1 • DENVER 2 • DETROIT 2 HOUSTON 2 • INDIANAPOLIS 4 • KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3 • MILWAUKEE 2 • MINNEAPOLIS 4 • NEW YORK 7 • OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9 • ST. LOUIS 3 • SALT LAKE CITY 1 • SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5 • *In Canada:* WAGNER ELECTRIC AT LEASIDE, ONTARIO—*Wagner motor parts are available at 350 Wagner-owned and -contract repair shops.*

STANDARD *or* UNDERSIZE

Ask for
JOHNSON EM BEARINGS

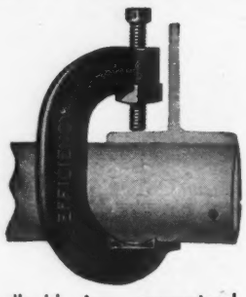
Catalogue
76 Pages, fully illustrated. Write for a copy TODAY.

• When you need Electric Motor Bearings ask for Johnson Bronze E M. Over 250 individual types, fully machined, ready for immediate use. Cast in a high lead alloy they are guaranteed to deliver the utmost in performance and long bearing life. Remember it's E M in Bearings . . . the highest quality available.

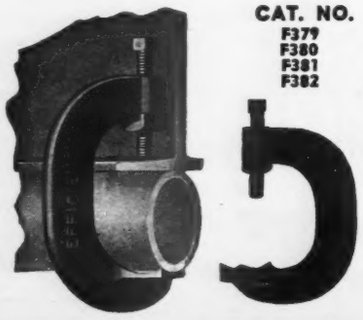
JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
490 S. MILL STREET NEW CASTLE, PA.

"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

EFFICIENCY CONDUIT HANGERS
FOR
INDUSTRIAL CONSTRUCTION



• The most practical and widely adaptable hanger ever devised for supporting conduit or armored cable on open steel construction. Will carry pipe at any angle to beam.



CAT. NO.
F379
F380
F381
F382

Highest grade malleable iron, guaranteed against breakage. Set screw, cup pointed, tightened by free nut, plus 5-point radiating ridges of gripping surface holds pipe on true mechanical principle, guaranteeing a solid, non-slip support.

FOR PIPE AND CABLE SIZES
For armored cable
For ½" and ¾" conduit
For 1", 1¼" and 1½" conduit
For 2" and 2½" conduit

WRITE TODAY for our Catalog No. 38 . . . contains complete information on this and other EFFICIENCY Electrical Devices

Efficiency ELECTRIC AND MANUFACTURING CO.

several elements could be placed in each pipe at different depths.

In place of thermostats, I would use small bi-metal strip switches, such as used in heating pads or similar devices. These would be set to close the circuit before a dangerous temperature was reached.

If not necessary to indicate the exact location, all these thermal units could be connected in parallel and any one closing the circuit would cause an alarm. If the definite location of the trouble should be indicated, it would be necessary to run a separate wire from each unit to an annunciator using a common return.

Eight to sixteen volt current should be used, either d-c from a battery, or a-c from a bell ringing transformer, as 110 volts would introduce an additional hazard. The alarm bell could be located at any point within reasonable distance. —A.E.T.

A. TO QUESTION 216—Not very effectively, as spontaneous combustion may break out at any point in the hay. The installation would not insure positive warning. However, if heat accumulated at a point where a thermostat was located, an alarm could be sounded.

The proper use of salt in filling the hay mow practically eliminates the chance of spontaneous combustion.—L.J.G.

A. TO QUESTION 216—It is probable that thermostats could be used to cause an alarm before combustion starts. This combustion is due to heat caused by oxidation or fermentation and this heat is present in all stacked hay. Therefore, it might be difficult to determine the exact temperature at which the thermostats should operate. This, of course, should be below the kindling temperature of the hay, which is in the order of 350° F, probably varying quite widely under varying conditions of moisture, etc.—C.P.S.

A. TO QUESTION 216—Yes, it should be quite possible to apply thermostats to a haystack in order to cause an alarm. The thermostats should be several in number and be distributed throughout the volume of the hay, as one spot might get hot enough to cause combustion while another spot might not. Setting of the thermostats should be well below the danger point of temperature.—L.R.B.

A. TO QUESTION 216—The use of thermostats or other heat indicating devices to indicate heating of hay before spontaneous combustion starts is theoretically possible; however, since hay is a poor conductor of heat, it is estimated that one thermal device for about every cubic yard of hay would

LOOK TO THE FUSE LEADER FOR PRODUCTION PROGRESS

WARE HI-LAG *Renewable* FUSES

HI-LAG LINK DESIGN—*Important!*

One piece thickness of renewal link, produces strong lag characteristics.

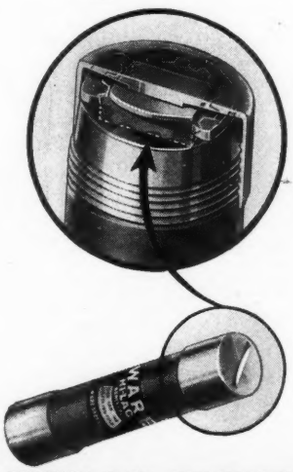
The WARE HI-LAG Renewable Links are designed to provide longer time lag for handling starting, as well as other temporary harmless overloads. Always assuring 100% Protection.

Note exclusive design of WARE HI-LAG Links: the square ends which increase contact areas and maintain low resistance without overheating; the wide metal areas in body, which absorb excessive heat from motor starting current and short heavy surges; the narrow cross members, which allow for expansion without sharp bending; the fusing points, which open with a minimum of arcing on short circuits.

No fuse is more dependable than its link. The WARE HI-LAG Renewable Link of one piece and uniform thickness, insures dependable absorption of heat for time lag. Other exclusive features include the Spring Tension Locking of Links into Circuit—Double Bridge Knife-Blade Assembly—Gas Vents and Simplified Construction, only 3 Parts.

Investigate today! Start economizing with the World's Best and Coolest Operating Fuse.

Write for Brochure giving details of all the COOL FACTS, sizes and prices.



HI-LAG FERRULE FUSE CONSTRUCTION

Our ferrule type fuse has a heavy brass bar, which locks into open end ferrule, bridging fuse case. This bridge locks link to prevent twisting and cap tightens on new center contact. No sagging washers or twisted links to cause overheating.

WARE Brothers 4450 W. LAKE ST.·· CHICAGO 24, ILL.

KLIPLOK

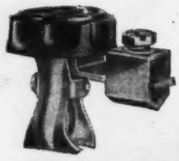
supplies the needed

PRESSURE That STAYS ..and PAYS

There's no chance for faulty contact between fuses and clips when TRICO KLIPLOK CLAMPS are applied.

The vice-like pressure locks them together—your insurance against premature fuse blowings—unnecessary shutdowns, wasted current—fire and accident hazards.

Order from your Jobber, or write for Bulletin #6-A



TRICO

TEST CLAMPS

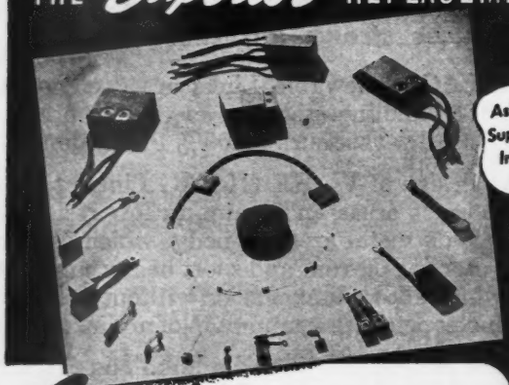
A heavy duty clamp that carries extremely heavy currents and "stays put" when attached. Used for temporary connections, for motor and meter testing, jumpers, etc.

Made in 7 sizes—0 to 300 amperes.

TRICO FUSE MFG. CO. Milwaukee 12, Wis.

In Canada—IRVING SMITH LIMITED—Montreal

THE *Superior* REPLACEMENT...



Ask us about Superior Silver Impregnated Brushes

Superior Carbon Brushes

Superior Carbon Brushes are already standard equipment on more than 30 makes of electric motors. The experience thus suggested — "since 1919"— is your assurance that Superior brushes excel likewise for replacement purposes. A wide range of grades, including carbon, graphite, electrographitic, metal graphite. A wide range of uses, from heavy duty motor and generator service to fractional horsepower motors for household gadgets. Ask your nearest Superior distributor about *Superior* replacements.

SUPERIOR CARBON PRODUCTS, INC.

9113 George Ave. Cleveland 5, O.

Since 1919

SUPERIOR CARBON BRUSHES

be necessary (about ten to a ton) to provide any real protection. The cost of such an installation along with its interference with the normal handling of hay would be out of line with the protection provided.—R.E.

Can you ANSWER these QUESTIONS

QUESTION T9—If the brush gear setting has been lost on a direct current generator after dismantling, what is the proper procedure to restore correct setting of brush gear to this generator which has a four coil field? Also, what is an easy way to determine which has the positive lead from the negative lead?—R.M.H.

QUESTION U9—Why is it that a storage battery will discharge itself more quickly while setting on concrete than on a wood support? Hydrometer readings were taken after recharging that were approximately the same; but after a lapse of several hours those in contact with the concrete showed a lower reading. There was no load connected and all the batteries were in A-1 condition.—S.M.K.

QUESTION V9—What would be the effect on a wound rotor induction motor if one of the secondary circuit conductors were opened? (This would also be caused by an open circuit in the secondardy controller.) I contend that the motor would operate somewhat as a squirrel cage motor with one phase open, i.e., at reduced speed and torque. Am I correct in assuming this?—W.R.S.

QUESTION W9—I would like to know whether it is practical to heat a large amount of water by electricity.

A customer of mine wants to heat five green houses by electricity. At present, he is heating by hot water using two 80 hp. boilers and burning 300 cords of wood in six months. It is a lot of bother and he wants it more convenient.

I don't know the capacity of the boilers in gallons of water. Leading from the boilers through the green houses are 70 two-hundred-foot runs of 2 inch pipe with five 20 ft. runs of 6 inch pipe across the ends of the houses.

Would it be more economical for him to continue to heat with hot water using electricity to heat the water or to use space heaters?

How would I go about to figure the load it would take to heat the water? Is there any way of telling how much electricity it would take to heat 100 gallons of water to 212° F?—J.H.M.

PLEASE SEND IN YOUR ANSWERS BY JUNE 1

"I've tried them all... THIS IS THE STARTER FOR *ME*!"

Ask any experienced maintenance man what across-the-line starter he prefers. Chances are he'll say "Allen-Bradley." The reason—Allen-Bradley solenoid starters are practically trouble-free. The patented, silver alloy contacts never need maintenance. The solenoid plunger is the only moving part. It moves through frictionless, stainless steel guides. Potential troublemakers such as bearings, pins, hinges, pivots, and flexible connectors are entirely eliminated on these starters. Specify Allen-Bradley on your next starter job . . . it pays!

ASK YOUR MAINTENANCE MAN— HE KNOWS!

NO CONTACT MAINTENANCE

with these Double Break, Silver Alloy Contacts

The contacts of all Allen-Bradley solenoid starters are of patented cadmium silver alloy. Oxides which may form on these contacts are good electrical conductors. Hence, the contacts never need cleaning, filing, or dressing. By avoiding contact maintenance you not only save valuable contact life, but also maintenance time and trouble. In addition, the double break contact construction eliminates flexible jumpers—a frequent source of trouble.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

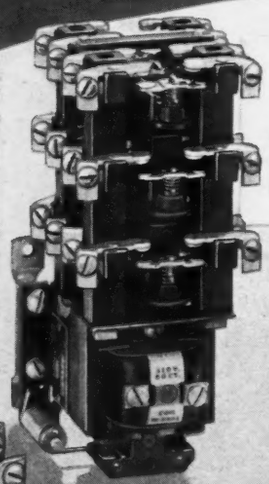
RUGGED
TROUBLE-FREE

BULLETIN 700

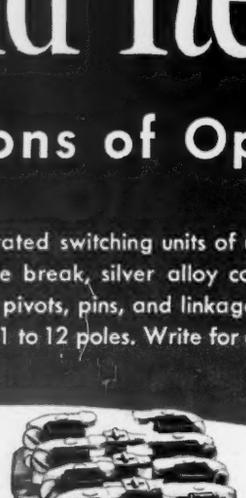
Solenoid Relays

Good for Millions of Operations

A complete line of small, solenoid operated switching units of unfailing dependability. Bulletin 700 solenoid relays have double break, silver alloy contacts that never need filing, cleaning, or dressing. All bearings, pivots, pins, and linkages are eliminated. There is only one moving part. Available in from 1 to 12 poles. Write for complete information.

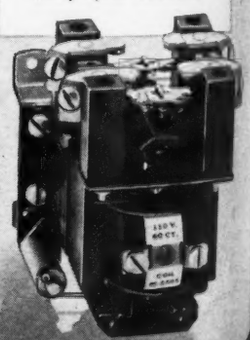


TYPE B-840
12-Pole relay with eight normally open contacts and four normally closed contacts.

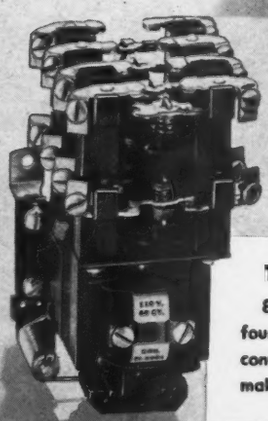


TYPE B-400
4-Pole solenoid relay with four normally open contacts.

TYPE B-200
2-Pole solenoid relay with two normally open contacts.



TYPE B-440X
4-Pole relay with "up-and-down" contacts — any contact may be wired to provide either normally open or normally closed operation. Carry this relay in stock and you'll have the "right" relay on hand at all times.



TYPE B-440
8-Pole relay with four normally open contacts and four normally closed contacts.

Allen-Bradley Company
1316 S. Second Street, Milwaukee 4, Wis.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A-B Quality

WIRING FOR WORLD SECURITY

[FROM PAGE 63]

installations although the U.N. installation went far smoother due to the excellent work of the electrical contractor and the acoustical consultant. All proceedings of the Council were recorded on embossed film, on high fidelity transcription discs for documentary purposes and on a German-invented Megnetophon metallic-paper tape used in America for the first time at the U. N. sessions. Proceedings of closed conferences were also recorded on wire.

Audio leads also traveled from the control booth to all radio booths for rebroadcasting purposes. The radio booths were occupied by all major American and Canadian networks and radio stations and several international agencies beaming short wave broadcasts of the meetings overseas to other countries.

Underfloor troughs were provided to carry wiring throughout the audience for individual earphones. This provided an alternative in case it was decided to disconnect the P. A. system. The advantage of earphones would have been to eliminate the monotony of listening to long speeches in unknown tongues over the loud speakers and an interpreted speech could be heard with greater concentration.

Conference Room

Flanking the main chamber to the east and west were two 40 by 60-foot rooms which formerly served Hunter College students and, during the war, the WAVES as additional gymnasiums. As in the main chamber, athletic equipment was removed from the girders and tile walls, fireproofed chocolate-brown sailcloth was draped over the walls and a lighter colored brown carpeting installed over the entire floor areas. Six large, specially designed lighting fixtures were suspended below the 20-foot white-painted concrete ceiling at a drop distance of five feet.

The east wing became a Conference Room, also being used for Press overflow, and eight television sets were installed so that reporters or conferees could relax away from the public eye and still hear and see all that was transpiring in the Council Chamber. Provision was made for four additional sets although the demand did not arise. The television camera recording the proceedings in the chamber employed the "image orthocon" tube, permitting maximum transmission results with minimum light on the dais. The totally indirect ceiling fixtures were shallow cones, four feet in diameter and a foot in depth. Each unit housed ten 150-watt R-40 flood lamps and the required capacity was furnished to each fixture by double circuits.

Lounge

The west wing became the Delegates' Lounge Room with three small 8 by 16-foot private conference rooms opening from the south wall. Lighting in the lounge was from circular, translucent, flat glass fixtures containing 500-watt silvered bowl lamps. A vertical edging of 3-inch polished aluminum shielded the eyes of delegates from direct rays of light. Utility and telephone outlets supplied additional conveniences. Provision was also made for a loud speaker. The small conference rooms were lighted with 300-watt fixtures and were provided with telephone and wall outlets.

Press Floor

The entire basement was converted to accommodate the Press and the telephone exchange. To increase the floor area, the swimming pool was covered by supporting a gridwork of shallow I-beams in the scuppers and laying precast concrete slabs over the framework. Partitions consisted of plaster board bolted to vertical steel joists. Flexible conduit, strung along the top of these unpainted and uncovered partitions, carried the power for the 100 teletype machines operated by WU, AP, UP, INS, TAAS, Reuters, France and the leading national newspapers and news syndicates. Press Wireless radiophoto service transmitted and received photographs, maps, sketches, documents, cartoons and line drawings for the many newspapers, press associations, periodicals, and radio stations represented at the meetings.

The telephone service, not installed by the electrical contractor, consisted of special switchboards, long banks of booths in hallways and on the press floor as well as numerous extensions throughout the building.

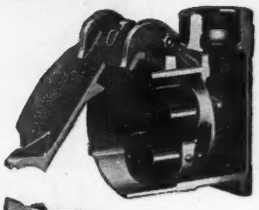
Two loud speakers and two television sets were located in the Press Lounge.

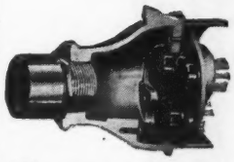
The original basement lighting illuminated the press area.

Conclusion

In physical scope the job was impressive; listing over ten miles of power cable, 100 miles of audio wiring and over 100 kw. of lighting for the single building; but even more noteworthy was the thoroughly cooperative attitude of those who worked to accomplish the job in the two-week span.

MULTIPLE UNIT plugs and receptacles





3 unit sectional view.

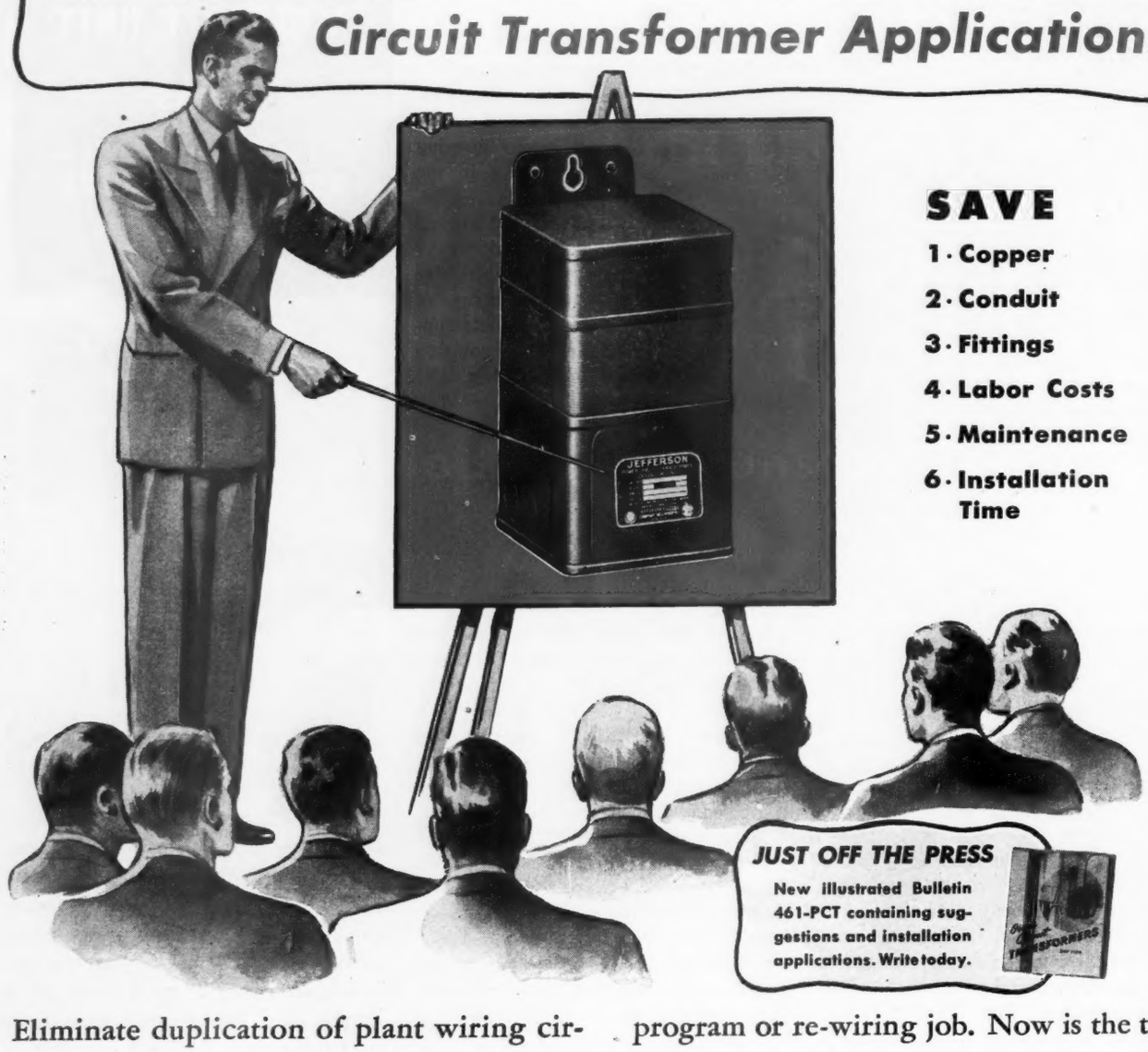
1, 2, 3, 4, 6, 8 pole interchangeable contact units.

Any combination, 2 to 32 poles, for thermocouples, sound equipment, remote controls, lighting and motor wiring. Interchangeable contact units—1 to 8 poles—can be assembled in 2, 3, or 4 unit plug shells and receptacle housings to make any desired combination of circuits. Equipment can be arranged with the protected female contact units in either plug or receptacle, for safety in line side of the circuit. Ground protection is provided. A full line of plug shells, cable connectors, and standard receptacles allows the widest range of assembly combinations, to meet any needs. Consult your Pylet catalog for complete specifications.

THE PYLE-NATIONAL COMPANY

1344 N. Kostner Avenue, Chicago 51, Illinois

Electrical Men! Get the Facts on Power Circuit Transformer Applications



SAVE

1 · Copper
2 · Conduit
3 · Fittings
4 · Labor Costs
5 · Maintenance
6 · Installation Time

JUST OFF THE PRESS

New illustrated Bulletin 461-PCT containing suggestions and installation applications. Write today.

Eliminate duplication of plant wiring circuits and costs by placing Jefferson Power Circuit Transformers at convenient intervals to provide lower voltage service from the higher-voltage, low-rate system. Jefferson Transformers are the dry type and may be mounted on wall, post, or directly on the machine to supply 115-230 volt current to lights, controls, relays and other small electric equipment.

Save time, expense and increase efficiency by installing Jefferson Transformers and distributing only the higher voltage in your new plant, or for your modernizing program or re-wiring job. Now is the time to make your plans. Write for latest Bulletin mentioned above . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Chicago Suburb), Illinois. *In Canada:* Canadian Jefferson Electric Co., Ltd., 384 Pape Ave., Toronto, Ont.

JEFFERSON ELECTRIC

Power Circuit • Dry Type

TRANSFORMERS

MOTOR SHOPS

DIP-DRIP-DRY STEPS COMBINED

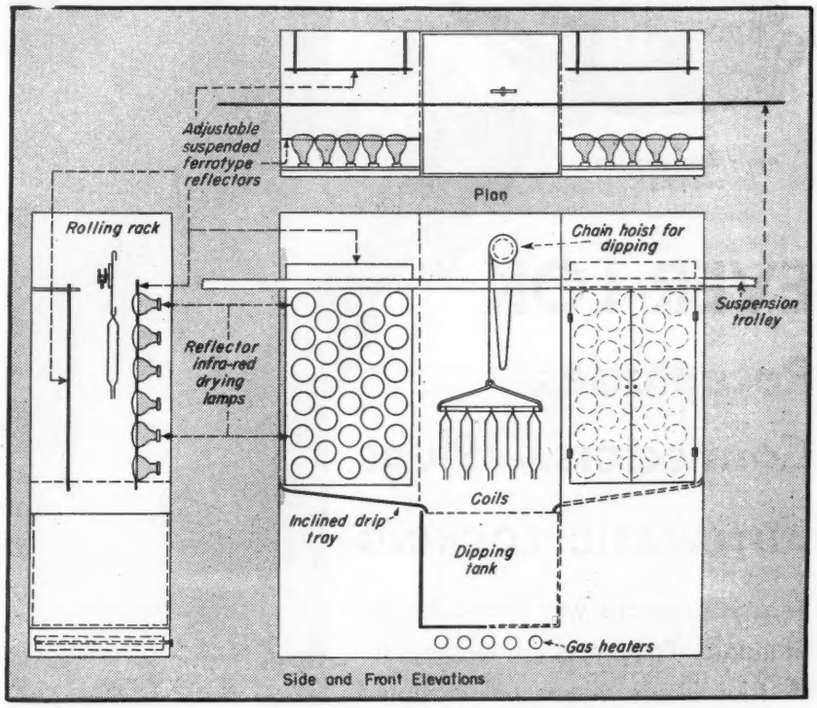
A compact, neat and efficient coil winding shop, located in the H. N. Crowder Jr. plant at Allentown, Pa., is designed to localize all dip-drip-dry operations, improve cleanliness and conserve operator energy.

As coils are wound, they are suspended from hooks placed along the lower edges of rolling racks. These two-wheel rolling racks rest on an overhead monorail located just above the heads of workers at the coil winding benches. As each rack becomes filled with hanging coils, it is pushed along the monorail which runs across the shop and terminates at the dipping-drying unit.

The rack, with coils untouched, are linked to a yoke and lowered by a chain hoist into the dipping tank. The tank is kept at constant temperature by means of gas fired heaters placed beneath the unit. Gas regulating controls are readily accessible, being placed on the lower face of the tank.

On completing the dipping cycle the rack and coils are raised by the chain hoist, the wheels of the rolling racks are placed on an overhead suspension trolley and the rack is pushed sideways, either to the left or to the right, into one of two adjacent drying and baking passageways which flank the dipping tank. Each bake oven contains 28–250-watt reflector infra-red drying lamps arranged in tiers alternately containing three and two lamps per row. Horizontal and vertical rows of lamps are spaced at 6-inch intervals but the staggered arrangement of bulbs results in a minimum socket-to-socket span of 8½ inches. Each horizontal row is individually switched so that, depending on the depth of the hanging coils, only those lamps located to supply effective heat need be placed in service.

Two ferrotype reflecting shields confine the heat to the narrow air gap immediately surrounding the baking coils. The front sheet is perforated with a series of circular openings, corresponding in pattern to the arrangement of lamps and sized slightly larger than the greatest diameter of the lamps. This front sheet is located vertically at the shoulder point of the lamps and acts as a secondary heat baffle. The primary baffle is the rear ferrotype plate which can be adjusted either forward or backward, depending on the horizontal space required to accommodate the racks and coils. Limiting this width of the drying passageways concentrates baking action and reduces the required time interval of the baking cycle. The average time experienced with the arrangement discussed is slightly under two hours.



Dip-drip-dry assembly combines dipping tank, two baking passageways and inclined drip trays which catch and return by gravity any excess varnish. Suspension trolley carries rolling racks through the drying ovens. Adjustable ferrotype heat baffles confine baking action to narrow passageway surrounding coils being baked.

Inclined trays in the drying stalls are placed below the lower edges of the ferrotype reflectors. The lower lips of the inclined trays overlap the sides of the dipping tanks and any dripping varnish returns by gravity to the tank.

When the coils are completely baked the racks are pushed out of the baking passageway along the continuous suspension trolley. When the coils are removed and carried to the next operation, the rolling racks are lifted from the trolley and replaced above the coil-winding benches on the overhead monorail, ready for reuse.

Throughout the dip-drip-dry routine, manual handling of the coils is at a minimum. Since wet coils do not have to be transported across the shop floor to the baking ovens, dripping is confined to the drip trays and the floor remains dry, unspotted and neat. Extra steps are cut due to overhead rails carrying the racks from winding bench to dipping tank, through the drying passageways and out to the next operation. Light racks may be lifted if desired but the chain hoist is available to raise and lower coils or heavier items for dipping. Strains are eliminated and energy is conserved.

STATOR PULLING RIG

Considerable time is ordinarily required to sufficiently heat a stator so that the coils may be pulled easily. To provide rush jobs when there is time for only a little preliminary heating, the Quality Electric Co., of San Francisco, built this sturdy steel bench which is securely bolted to the floor. There are slots in the bench top through which hooked rods can be passed upwards and hooked over the stator frame as shown in the picture. These rods are threaded

Heavy duty receptacle and plug

EVER-LOK
Receptacles, Connectors *and* Plugs
AUTOMATIC LOCKING

Ten (10) reasons why Ever-Loks are Standard Equipment in leading Industrial Plants where uninterrupted service is vital. →

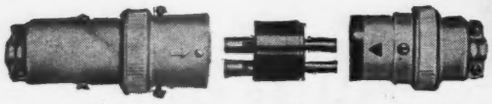
Ever-Lok protects against every contingency including abuse and frequent and hard usage.

For light and power circuits, 2, 3 and 4 poles, 10 to 200 Amperes.

For public address and control circuits 2 to 12 poles, 250 Volts.

Complete Catalog on Request.

1. Automatic locking
2. Positive grounding
3. Polarized
4. Metal clad
5. Full contact protection
6. Adjustable cord grip
7. Self-wiping, self-aligning contacts
8. Interiors precision moulded
9. Unit Assembly easy wiring
10. Fusible or non-fusible



New Ever-Lok Connector with midget fuses for high cycle tools and small portable equipment.

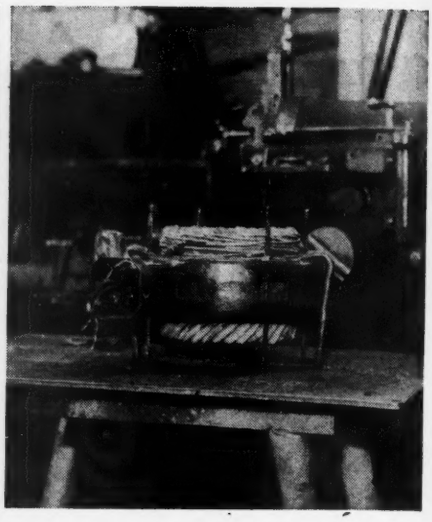
37

Since 1902 **Please address Dept. No. A**

RUSSELL & STOLL COMPANY

EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES AND EQUIPMENT. AUTOMATIC LOCKING "EVER-LOK" CONNECTORS

125 BARCLAY STREET · NEW YORK 7, N. Y.



Stator stripping bench is bolted to floor for hoist coil pulling.

at the lower end and drawn down tight with nuts.

The stator is first held with the connection end up. The ends of the coils are then cut all around at the connection line with an air hammer, and that end of the coil released. The stator is then turned over, fastened down, and a hand operated shop hoist brought over, with a hook at the end of the hoist line, which hooks into the coil. The coils are then pulled out with the hoist.

If some individual wires still cling in the slots, an ordinary come-along is fastened to the hook with which to pull them individually.

Usually the stator is heated for about an hour. This plus the time for pulling is hardly as long as the burning time alone required to pull by ordinary procedure.

PIVOTED BOOM SERVES WIDE AREA

In many motor shops, heavy equipment repair work often is concentrated into a relatively compact area. Loads of several tons are repeatedly shifted, delivered for repair or picked up for redelivery to other shops or to the shipping office. It is both convenient and necessary to provide these areas with a means for effectively serving the entire floor space with mobile hoisting equipment.

Overhead, two-rail traveling cranes fill this need but, in concentrated working areas, due to the short effective run of the equipment, the double rail and rolling crane constitute an uneconomical solution to the problem. A rigid monorail and chain hoist constricts the area served to a narrow corridor immediately beneath and adjacent to the overhead I-beam and moving the equipment from this limited aisle involves the use of a dolly and double handling.

FEATURING all-round job efficiency!

ACCURATE TAPES

Asked for by name by users everywhere—proof of the economy and dependability of ACCURATE tapes.

Tested and approved by industry for over twenty-five years—your guarantee of maximum service

FOR over twenty-five years, high quality ACCURATE tapes have been a consistent repeat sales item. Users ask for them by name and for good reason, for these tapes wrap fast, stick permanently . . . provide a smooth, lasting, protective covering with a minimum of effort. Also, ACCURATE friction tapes are non-raveling, strong. They tear off clean and are super-calendered for through and through impregnation. ACCURATE rubber tapes—highly elastic—provide maximum dielectric strength in a minimum space. Materials used in both types are supplied to exacting specifications, and are rigidly inspected prior to use—your assurance of absolute dependability and satisfaction. All tapes available on short notice . . . in any quantity. Your inquiries are invited.

FEATURING, also, important field-tested improvements—both electrical and mechanical—that lower job costs through speedier, easier, installation!

ACCURATE MFG. COMPANY

OVER A QUARTER CENTURY OF TAPE SPECIALIZATION

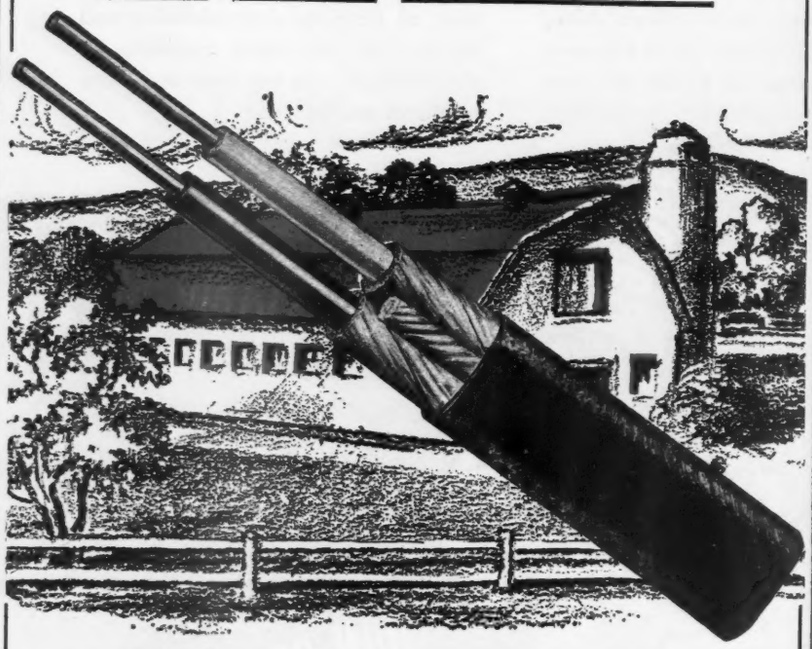
GENERAL OFFICES and PLANT: GARFIELD, NEW JERSEY

CRESFLEX

NON-METALLIC SHEATHED CABLE

With TYPE T Conductors

Has Many Advantages



A SAFE, PERMANENT low cost cable for interior wiring. The use of SYNTHOL Type T conductors results in a smaller, lighter weight cable, which makes it easier to install and takes less space. The SYNTHOL thermoplastic insulation on the conductors has long life, high dielectric and mechanical strength, and is extremely resistant to moisture, acids, alkali and mildew. Will not burn and is free and clean stripping.

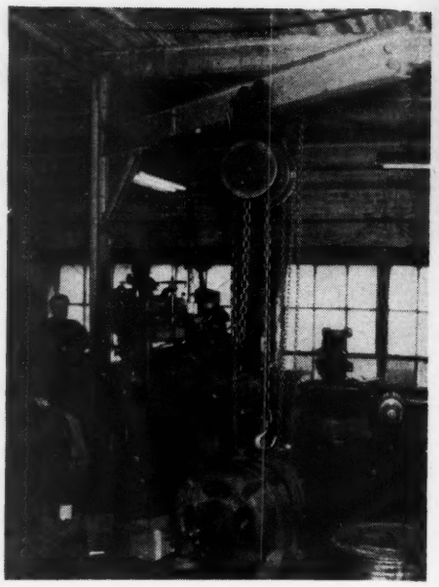
Recommended for farm and rural buildings, as well as for all types of residential construction.

CRESCENT

WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.



Two-ton chain hoist rolls along I-beam monorail which is cantilevered to pivoted, rotating upright H-column. Hoist facilities are provided to circular area with radius equal to run of monorail. Downward load component is transmitted to floor, permitting lighter overhead construction.

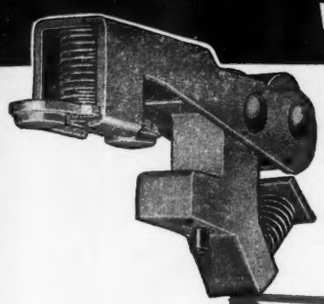
A cantilever monorail boom, rigidly affixed to a rotating upright, is the practical answer. Swinging the pivoted beam to the desired azimuth and locating the chain hoist the required distance from the fulcrum completely serves a circular area the radius of which is the length of monorail. Since the direct bearing load of the equipment raised is transmitted through the upright to the floor of the shop, overhead construction safely can be less massive than would be required otherwise. The arrangement eliminates double handling and is economical and efficient.

The repair department located in an upper wing of the O'Brien Machinery Company of Philadelphia, Pa., finds many uses for the swing hoist which quickly shifts heavy equipment delivered to the local area from one of their larger shops. A 2-ton Peerless chain hoist rolls along an 18-foot I-beam riveted at one end to a vertical, pivoted H-column. Rigidity is increased and bending moment distributed through triangular web plates above and below the juncture. Pivot pins in the H-column pierce channel irons in ceiling and floor. Twin bolts through the monorail web at the outboard end act as limit stops, preventing the hoist from rolling from the beam.

COMPACT DEAD-FRONT SHOP TEST PANEL

Adequate test facilities in the small motor shop is somewhat of a problem, particularly where space is at a pre-

"3C" Simplifies FOOT SWITCH MAINTENANCE with STANDARD CONTACT FINGER



Type FSA-22, 2 Pole, Horizontal Mounting, Left Side Operation, Open View.

ONE CONTACT FINGER ASSEMBLY FITS THEM ALL!

● Minimum maintenance—even on such a small part as this moving finger assembly, helps speed production and reduce costs. The contact finger assembly illustrated fits every one of the foot-operated switches illustrated—also Bulletin 101 Master Switches, Bulletin 102 Cam Limit Switches, Bulletin 102 Hatchway Limit Switches, and Bulletin 102 Track Type Limit Switches. Thus, in plants using several different types of switches, maintenance is simplified because the same spare part fits them all. Double break silver-to-silver contacts, requiring no filing nor dressing since oxidization will not cause poor contact, also reduces maintenance. When replacements are needed, a simple twist of the fingers removes the contacts and the pressure spring will not fly out.

Our Distributors and District Offices will welcome your inquiries. Ask for "3C" Bulletin 101-FS

Type FSVA-11, 22 or 33, 1 or 2 Pole, with Latch. Vertical Mounting.

Showing Safety Shield and Floor Plate available on 1 or 2 Pole Switches only.

Type FSA-44 4-Pole.

Type FRSA-44 4-Pole, 3 position.

Type FWLSA-22—2 Pole Sequence operation, with Latch.

THE CLARK CONTROLLER CO.

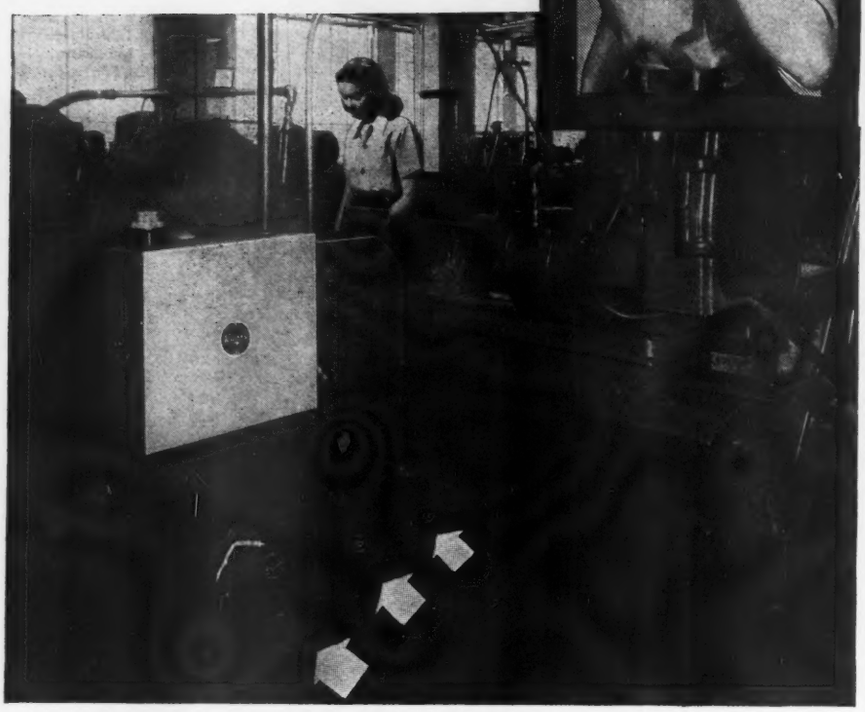
1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

SHE DOESN'T KNOW A

relay

FROM A

resistor

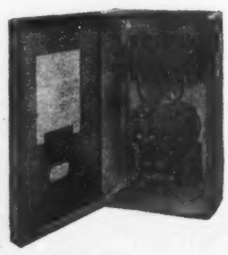


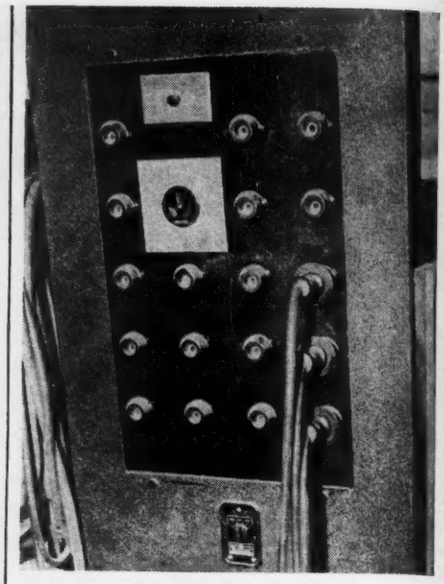
YET SHE CAN BE THANKFUL FOR THE BUILT-IN DEPENDABILITY OF

Federal NOARK MOTOR CONTROLS

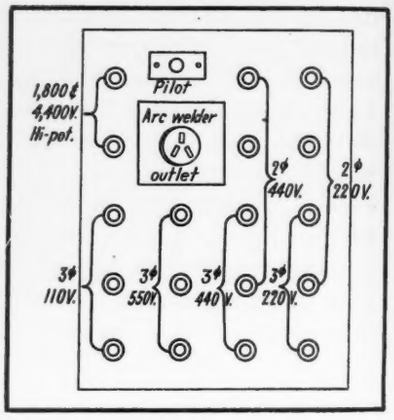
Like "ol' man river", her machine just keeps rolling along. Yet, behind the busy scene, often out of sight and out of mind, you'll find electrical control equipment bearing the honored name of Federal. Designed and built for year-after-year dependability, Federal products are specified wherever performance characteristics are measured in terms of production.

Federal Noark Combination Motor Starter: Bulletin 514 Size 1. 250v, 60 amp. fusible for motors up to 5 hp; equipped with motor circuit disconnect switch.





Compact, dead-front, multi-voltage, multi-phase test panel at Electric Service Company's Ann Arbor, Michigan, motor service department.



Jack-plug combinations that give the various test voltages available on the board.

mium. Most test boards end up as cumbersome, space consuming appurtenances. Neatest solution to this shop puzzler was found in the motor repair department of the Electric Service Company, Ann Arbor, Michigan. Here, a compact, multi-phase test board takes up less floor space than a bridge table and, being dead-front, is located in the center of shop within easy reach of work bench.

The board consists of 18 single-pole outlets for jack-plugs, a three-pole welder receptacle and a pilot light. A single 7½-kva. transformer provides facilities for single and three-phase, 110-, 220-, 440-, and 550-volt tests; also two-phase, 220-, and 440-volts. A second transformer provides 1,800 and 4,400 high-potential test facilities. Sets of heavy-duty, rubber covered, single-conductor, test leads with spring clips complete the test equipment.

The convenience of the board's location, its versatility and safe construction, classes the unit as a definite improvement in shop design.

The New HARVEL 912-C
Internal Curing INSULATING VARNISH

Cuts CURING TIME UP TO 50%

Compare These Schedules with YOURS

912 C Curing Schedules
(Standard convection ovens)

2-4 hours . 285 deg. F.

3-5 hours . 260 deg. F.

4-6 hours . 250 deg. F.

(all curing times lower with infra-red equipment)

Here's a new insulating varnish, recently developed by IRVINGTON, which cuts curing time substantially! It is used with *existing equipment.*

Compare your present schedules with the baking times given above. Then estimate the savings in costs as well as the increased output. And remember, you can effect these savings without investing in equipment.

Moreover, 912 C provides *greater storage stability* and *shelf life,* yet has all the outstanding electrical and physical advantages of other HARVEL internal curing varnishes. For complete information, and samples, write to Dept. 96, Irvington Varnish and Insulator Company, Irvington 11, New Jersey.

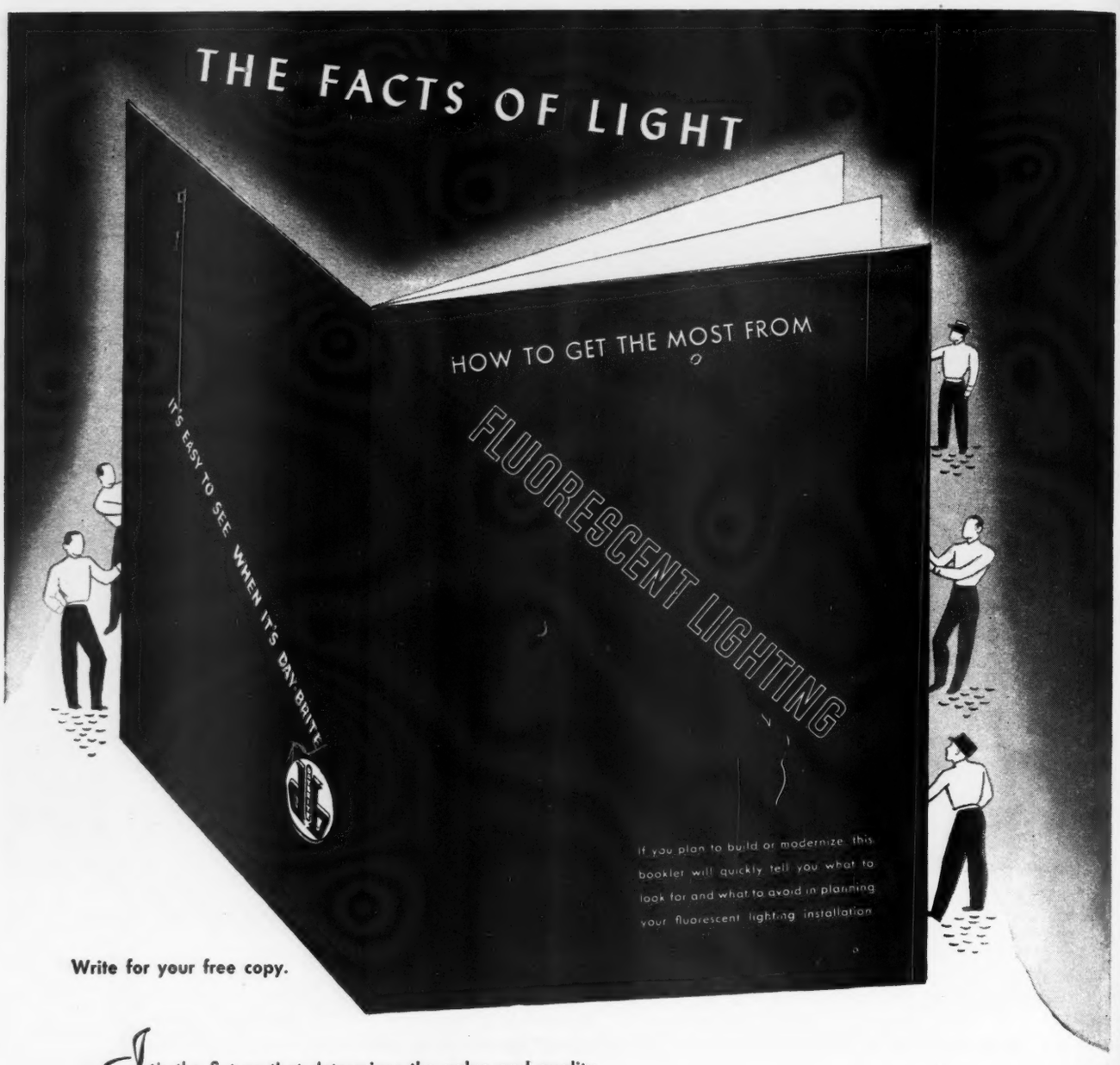
Irvington Products *Include*

- Cotton, Fiberglas, or Rayon Tubings and Sleevings — Varnished, Lacquered, or Vinylite Processed
- Non-Fraying Fiberglas Sleeving
- Transformer Lead Tubings
- Wire Identification Markers — Varnished or Plastic
- Extruded Plastic Tubings
- Fibron Plastic Tapes
- Varnished Fabrics and Papers
- Slot Insulation
- Harvel and Irvington Insulating Varnishes
- Cardolite Resins

STANDARD OF THE WORLD
IRVINGTON INSULATION
REG. U.S. PAT. OFF.

IRVINGTON

VARNISH & INSULATOR CO., Irvington 11, New Jersey


THE FACTS OF LIGHT
HOW TO GET THE MOST FROM
FLUORESCENT LIGHTING
IT'S EASY TO SEE WHEN IT'S DAY-BRITE
If you plan to build or modernize this booklet will quickly tell you what to look for and what to avoid in planning your fluorescent lighting installation

Write for your free copy.

It's the fixture that determines the value and quality of a lighting installation—the fluorescent tube produces only light.

Only sturdily built, scientifically designed fixtures can give you *all* the benefits of modern fluorescent lighting—overall, glareless, abundant light—lasting efficiency and easy maintenance.

The demand for fluorescent fixtures is greater than the present production capacity of qualified manufacturers. Waiting a little longer for better fixtures will pay in the long run.

Day-Brite Lighting, Inc., 5401 Bulwer Ave., St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario

1068

IT'S EASY TO SEE WHEN IT'S
DAY-BRITE

MODERN LIGHTING

MODERN ECONOMICS SEMINAR ROOM

The Institute on Postwar Reconstruction, founded in 1943 under a grant from the Alfred P. Sloan Foundation, recently has been granted the exclusive use of a modern seminar room located in the East Building, Washington Square branch, New York University. The 21 by 23 foot room, likewise a gift from the Sloan Foundation, has been referred to as "a Classroom of Tomorrow" and has been designed specifically for the instruction and serious study of major economic problems by a selected group of economists, industrial and labor leaders, graduate students of New York University and representatives from the professions, finance and civic welfare groups.

Traditional classroom furniture, decorative treatment and illumination have been replaced by a harmonious combination of color, light, informal table arrangements and comfortable seating accommodations.

In selecting the motivating theme of restful informality two factors were considered. First, the room was to be used primarily for lecture and debate rather than for prolonged periods of eye fatiguing study and research, and secondly, the economic issues under discussion would have the intense interest of those participating in the seminars. For these reasons it was not considered vitally necessary to stress high intensities of illumination for close reading or to follow former standards which combined formal desk arrangements, stiff and serviceable rather than comfortable chairs and high level color and lighting treatments to stimulate the attentiveness and hold the interest of the group. The atmosphere achieved in the Alfred Sloan Seminar room tends to combine mental alertness with physical relaxation.

Adequate lighting for general illumination is provided by four suspended indirect luminous bowl fixtures using 300 watt bowl silvered lamps. Two shallow linear vaulted arches have been moulded gracefully between the construction beams, the apex of each arch being 12 feet above the floor. A suspension of 34 inches to top of fixture bowl allows even diffusion of the upward component of light against the white ceiling and the reflection to the conference tables. Local light from a standard IES type desk lamp high-lights the discussion leader's table, providing ample illumination for the reading of notes and text.

Two baseboard service outlets are located at either side of the front wall and two more are centered above and below the bookcases which occupy the entire rear wall of the study. These outlets fulfill the requirements of projection and recording apparatus, clocks, fans, and electrical demonstration equipment.

Soft green is the color motif, the walls being a medium shade while the floor covering is of a darker carpeting. Free hanging drapes border the Venetian blinds which cover the two five-foot six-inch wide windows. The U-shaped conference table comfortably provides room for 30 persons.

Shallow ceiling arches are lighted by 300 watt bowl silvered lamps in suspended indirect luminous bowl fixtures. General reflected illumination is evenly diffused to the surface of the tables while local light is provided discussion leader by IES type desk lamp.

MODERN FIXTURES FOR POLICE RADIO ROOMS

The radio control rooms of the Newark, New Jersey, police department are examples of combining high visual acuity with comfortable seeing. Balanced illumination throughout the entire area is achieved by using translucent deflectors on semi indirect luminaires that eliminate both brightness highlights and dark spots on walls and ceilings. Plainly modern in design, the fixtures throw a majority of light upwards to the light cream acoustical ceiling which reflects 70 percent of this light back into the working area.

Guth Cadet fixtures, each using two 40-watt 3500 degree white fluorescent lamps, are arranged end to end at a mounting height of 8 feet 9 inches above the floor. The ceiling height is 11 feet 2 inches.

Three rows of seven lighting units are spaced 7 feet apart in the 22 by 29-foot control room, indicating a consumption of 3.3 watts per square foot. After 1500 hours of service, readings taken 32 inches above the floor recorded 48-50 footcandles in the center of the room and 35-40 footcandles along the wall lines.

Two rows of five units are suspended over the transmitter with a row-to-row spacing of 8 feet. The 16 by 22 foot room has a lighting load of 2.8 watts per square foot. Although the centrally-located transmitters intercept and absorb

McGILL

Safety Vaporproof GUARDS... with Tight-sealing Globes

UL Approved by Underwriters

Safeguard Life and Property

Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGill Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

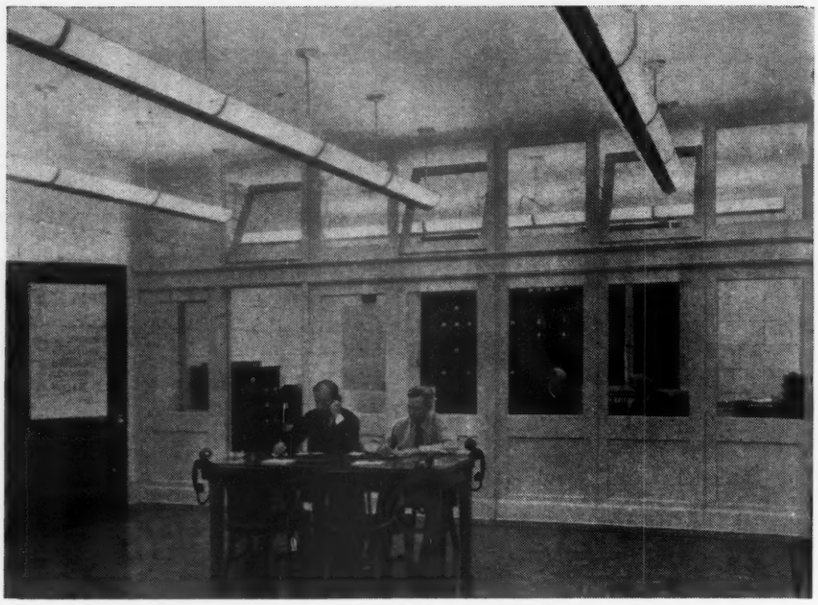
These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded — an additional safety feature.

McGILL

MANUFACTURING CO., INC.

Electrical Division

VALPARAISO, INDIANA



Balanced illumination is achieved by using translucent deflecting panels on continuous runs of suspended semi indirect luminaires. Excessive brightness and dark spots are eliminated from the reflected light which furnishes 25–50 footcandles to a working plane 32-inches above the floor.

much of the cross light between the fixtures, the light readings after 1500 hours of use were 25 footcandles in all parts of the room. The average coefficient of utilization is 40 percent.

The engineering of the installation was performed under the direction of B. J. Jensen, Ass't General Lighting Representative of the Public Service Electric and Gas Co., Newark.

COLD CATHODE LIGHTS COMPOSING ROOM

Cold cathode low voltage industrial reflector units, installed end to end to form continuous lines of light, were used by Baltimore Salesbook Company to relight the composing room in its large printing plant at Baltimore, Maryland. Previously lighted with incandescent industrial type reflectors located over work areas, the new layout provides a uniform intensity of light over the entire floor area, free from shadows, and of a color quality which makes seeing easy.

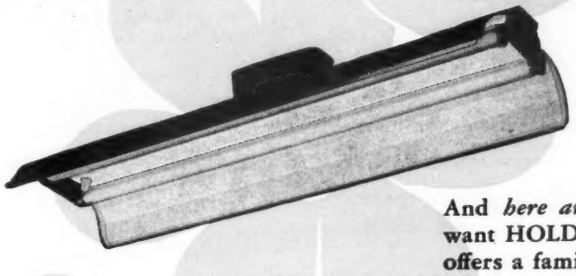
General Luminescent Corporation's

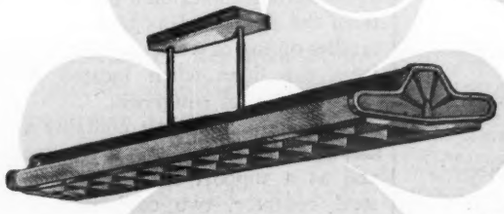
FIG. 1—Four-lamp low voltage cold cathode units are installed in continuous rows eight feet from floor on ten foot spacings in this composing room. Resultant illumination with 3500° white lamps is 40 footcandles average 30 inches from floor, higher on makeup tables.

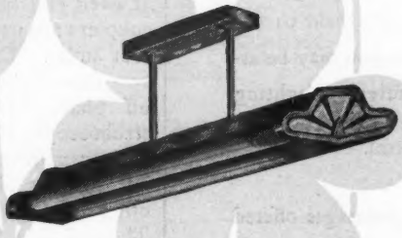
GROWING LIKE MAY FLOWERS

HOLDENline CHAN'L-RUN

Want profitable sales to blossom on every side like Spring flowers? Electrical contractors who recommend HOLDENline CHAN'L-RUN are getting them now! They've learned that HOLDENline CHAN'L-RUN sells easily and stays sold. Why? Because every HOLDENline unit is built on a rigid steel channel, the exclusive HOLDENline CHAN'L-RUN feature that assures the durability, strength and flexibility customers want in their installation.







And *here are some of the many reasons* why customers want HOLDENline CHAN'L-RUN: Now HOLDENline offers a family of industrial and commercial fixtures. In the striking new CHAN'L-RUN commercial line (LC series), a single basic unit comes three ways, for bare lamps, for side diffusing and a combination of side diffusing and bottom louvering, skillfully designed in four basic sizes—4-lamp 40-watt, 2-lamp 40-watt, 3-lamp 20-watt and 2-lamp 20-watt.

With the larger basic units your store and office customers can flood sales and working areas with high-level lighting. With the smaller HOLDENline CHAN'L-RUN related units, you can attain recommended levels in hallways, restrooms, circulation and similar areas.

Ask your Wholesaler for HOLDENline CHAN'L-RUN bulletin B-45, or write to . .

HOLDENLINE CO.

Pioneers in Fluorescent

2301 SCRANTON ROAD • CLEVELAND 13; OHIO

The CHAMPION **Fluorescent** and *Incandescent* Lamp distributor in *your* locality is the kind of distributor who knows that *your* best interests are *his* best interests. He has selected Champion Lamps for these practical reasons:

1. **Champion Quality**—guaranteed to equal or exceed Federal Specifications and backed up by the production resources and the forty-six years of lamp-making experience of one of the largest lamp manufacturers in the industry.

2. **Champion Economy**—the result of careful planning and specialization on the job of getting lamps to industry at minimum cost. The most lighting and the best lamps for your money is the objective of the Champion organization and the Champion distributor.

3. **Champion Service**—trained lighting experts in the field to cooperate with you and your supplier in order that you may be assured intelligent and efficient attention to your individual lighting and lamp needs.

Once you try Champion Lamps you'll appreciate these advantages offered you by the Champion distributor. May we give you his name and telephone number?

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

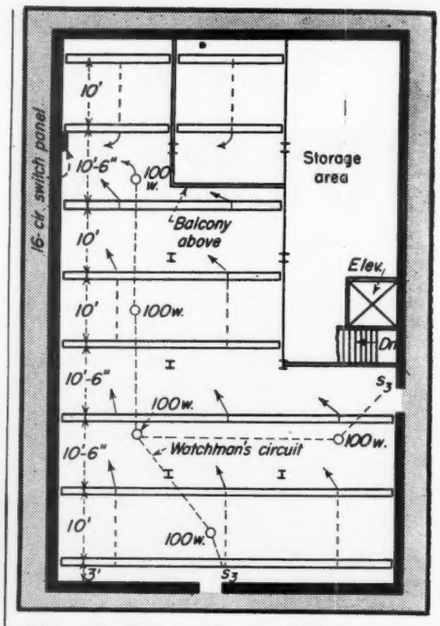


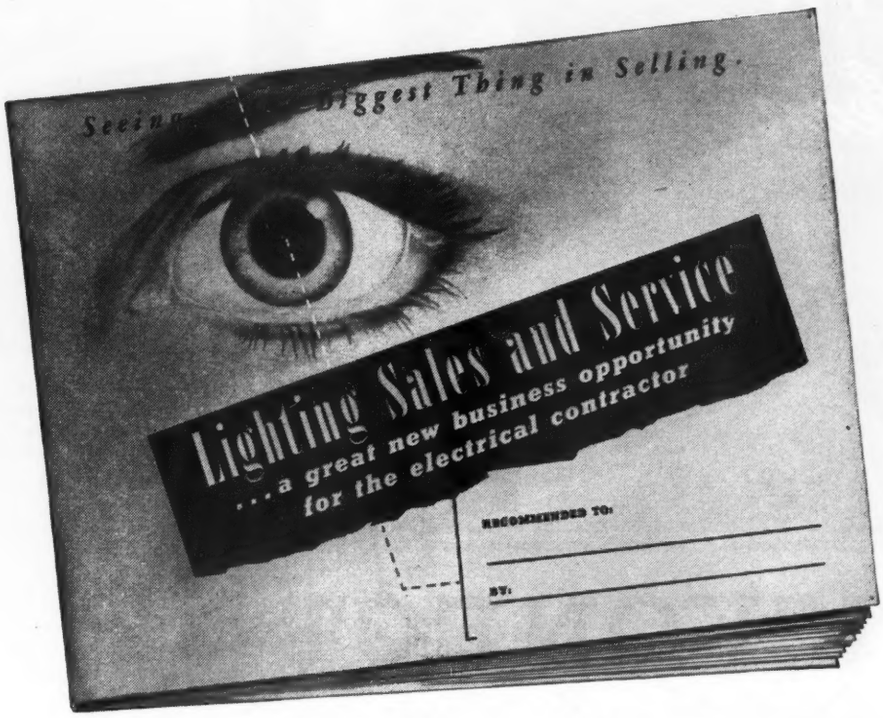
FIG. 2—Plan of composing room showing lighting and wiring layout in the printing plant of The Baltimore Salesbook Company, Baltimore, Md.

type FF-4 Coldvolt industrial fixtures were used. Each fixture is eight feet long, and equipped with four 93-inch, 25 mm. cold cathode 3500° white lamps. These individual units were installed end to end to form continuous rows, as shown in Fig. 1. The spacing between rows is approximately ten feet. All units were installed eight feet from the floor. The intensity, measured after approximately 500 hours of burning, was 35 to 40 footcandles on a plane 30 inches from the floor, and as high as 60 footcandles on top of work surfaces 50 inches from the floor when located directly under a row of equipment.

Each individual unit contains a steel channel which serves as a wire raceway, and as a support for a 17½-inch wide steel reflector, two cold cathode two-lamp transformers, and lamp housings at each end of the unit. Steel channel couplers are used to join individual eight foot units. Each transformer operates two cold cathode lamps, with one tube off phase with the other to correct stroboscopic effect. The two lamps on each transformer are connected in parallel, so that should one tube fail, the other tube will continue to operate. These 7 foot 9 inch long cold cathode lamps start on a voltage of 600 to 700 volts and operate on a voltage of between 430 and 460 volts at approximately 120 ma. Surface brightness of the 3500° white lamp is 3.4 candlepower per square inch.

A watchman's circuit, consisting of five 100 watt incandescent reflector units installed at strategic locations, and controlled by two 3-way switches, permits the watchman to inspect these premises without using the cold cathode system when the plant is not in operation.

CONTRACTORS!
Bigger Profits in Store Lighting!



A Billion Dollar Lighting Market Ready and Willing to Buy from You!

YOU'RE the key man in the store lighting market. And General Electric has prepared a complete lighting sales program especially for you—the electrical contractor.

"LIGHTING SALES AND SERVICE," the basic booklet in this program tells you what you need to know to go out and sell store lighting . . . lighting that will assure you every possible profit dollar. It gives you essential facts about:

1 the greatest store modernization activity in the history of the lighting industry.

2 the part that modern *sales* lighting plays in store modernization

3 the powerful promotional forces that will stimulate the demand for *better* store lighting

4 the profit possibilities in store lighting sales and service

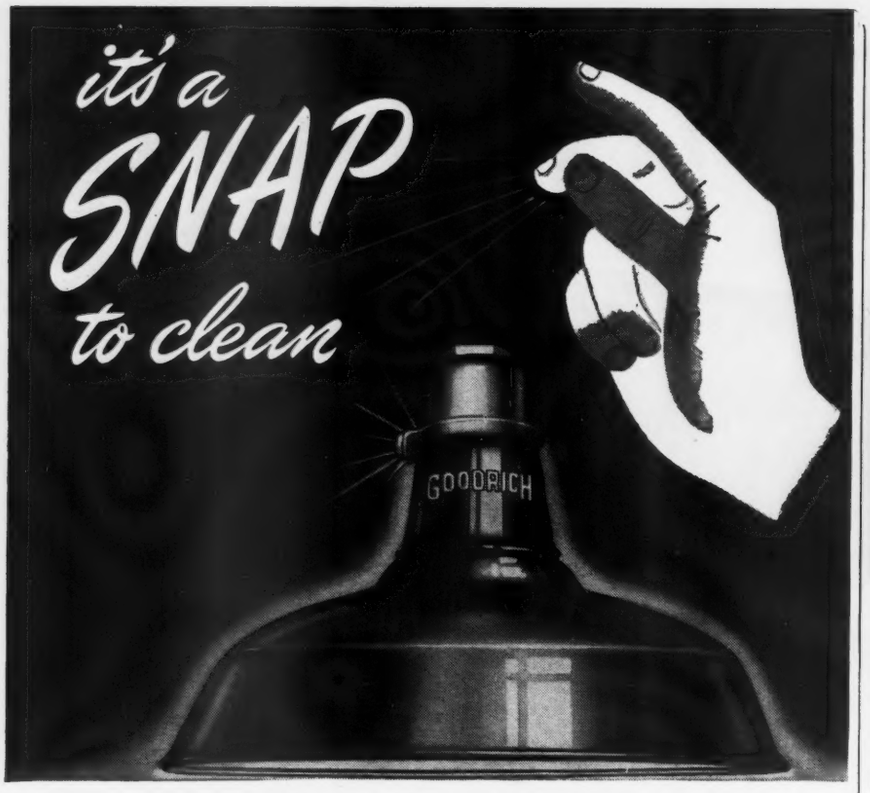
5 how *you* can capitalize on this great new business opportunity.

Don't miss out! Order your copy of "LIGHTING SALES AND SERVICE" *now* from your G-E Lamp Supplier or write direct to General Electric Company, Lamp Department, Nela Park, Cleveland 12, Ohio.

G-E LAMPS

GENERAL ELECTRIC

Research is Always at Work to Improve G-E Lamps and Make Them **STAY BRIGHTER LONGER !**



The DISKONECT

Simplest detachable reflector ever made

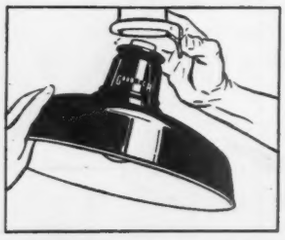
It snaps *off*—or on—in an instant! That's the Diskonect Reflector . . . ready to save time and trouble whenever you want to clean it. It's all done with a simple snap lock; sturdy, dependable.

To remove, just squeeze the hood and the trip latch releases reflector, socket and lamp as a unit. Complete "come-apart" construction permits cleaning of all parts separately.

To attach, just press the reflector back into the hood. When it clicks, it's locked securely. There's no twisting, tugging or forcing. No tools are needed. It lights as it locks.

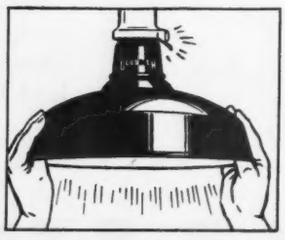
Finished in permanent porcelain enamel, Diskonect Reflectors are available in a variety of styles and sizes. Ask about them.

RLM



SNAP IT OFF! One hand does it with thumb pressure on the spring-set latch.

WASH IT! You can immerse the reflector completely—clean every part thoroughly.



SNAP IT ON! Just press reflector back into the hood. It lights as it locks.

Sold through Electrical Wholesalers.

GOODRICH
ELECTRIC COMPANY
4600 BELLE PLAINE AVENUE, CHICAGO 41, ILLINOIS

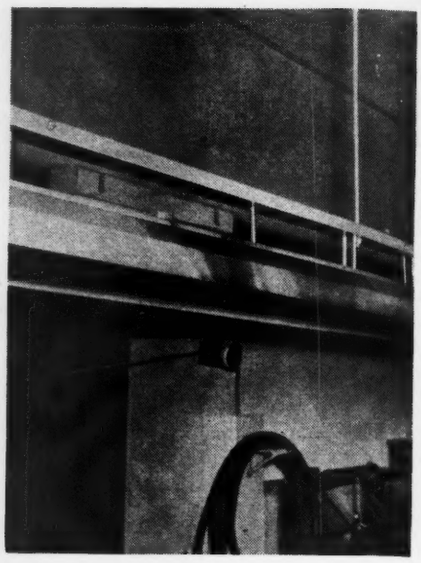


FIG. 3—U-channel, five inches wide, suspended on ½-inch conduit, is used to support eight foot long cold cathode reflector units and maintain alignment and rigidity.

One unique feature of this *planned lighting* system is the method developed by Roland Electric Company, electrical contractors who made the installation, for suspending the continuous rows of equipment. A continuous 5-inch U-channel was used over each row of equipment (Fig. 3). This U-channel is suspended from the ceiling by ½-inch conduit. The individual reflector units are in turn suspended six inches below this U-channel by two double and two single ½-inch conduit nipples. Each row of reflectors can thereby be aligned and held rigidly in place.

Some of the factors which influenced the selection of this system of lighting were:

1. Instant starting.
2. No auxiliary starting devices.
3. Long lamp life.
4. Reduced maintenance.
5. Long lamps permit uniform lighting, free from shadows.
6. Simplified wiring layout.

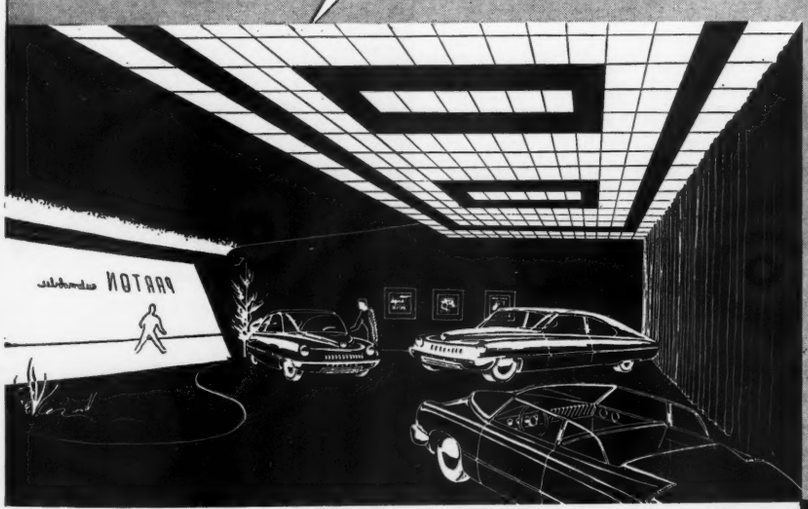
H. M. White, illuminating engineer, Consolidated Gas Electric Light and Power Company of Baltimore, cooperated with Roland Electric Company in the design and layout of this lighting installation.

DRAFTING PLAN HAS TRIPLE OBJECTIVE

Few occupations demand the protracted eye concentration required of the draftsman. Visual comfort, efficiency and accuracy in a drafting room largely depend on the quantity and quality of the lighting medium. To promote visual comfort by reducing glare from the specular surfaces of instruments and

Versatility in Lighting

CEILINGS UNLIMITED



Lighting which opens up new vistas in architectural design — CEILINGS UNLIMITED — for stores, offices, schools, factories, and public buildings, is provided by MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS. The patented MILLER CEILING FURRING HANGER makes possible suspension of ceilings from the lighting system and arrangement of units in continuous rows, blocks, or patterns, as desired . . . speeds installation . . . 50 to 75% less supports from structural ceiling needed. Its wireway assures 50% less wiring cost, and up to 80% less conduit and conduit fitting cost. MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS set LIGHTING on a new, high pinnacle of accomplishment.

THE MILLER COMPANY • MERIDEN, CONN.

Illuminating Division

- HEATING PRODUCTS DIVISION
- ILLUMINATING DIVISION
- FOUNDRY DIVISION
- ROLLING MILL DIVISION

MILLER
SINCE 1844

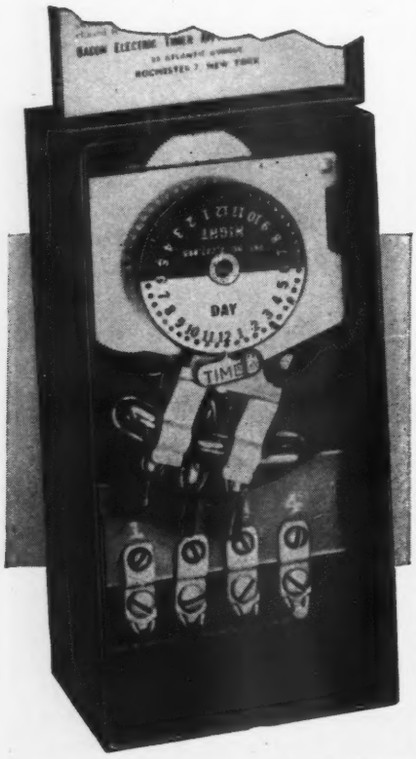
AUTOMATIC *Time-Control..*

. . . for poultry lighting and dimming, heating, ventilating, display lighting, signs . . . for practically any time - control operation.

Developed in 1936, the Bacon Automatic Switch has these outstanding features:

- **Performs from 1 to 18 pre-set operations in a 24-hour period.**
- **Will operate as a straight "off-on" switch or in a "dim-bright-dim" cycle.**
- **Only one moving arm is needed to operate the trouble-proof *mercury-to-mercury contacts.* These contacts, enclosed in a shock-proof Pyrex tube are the principal reason for the long-time performance record of the Bacon Switch.**

Write for Descriptive Literature



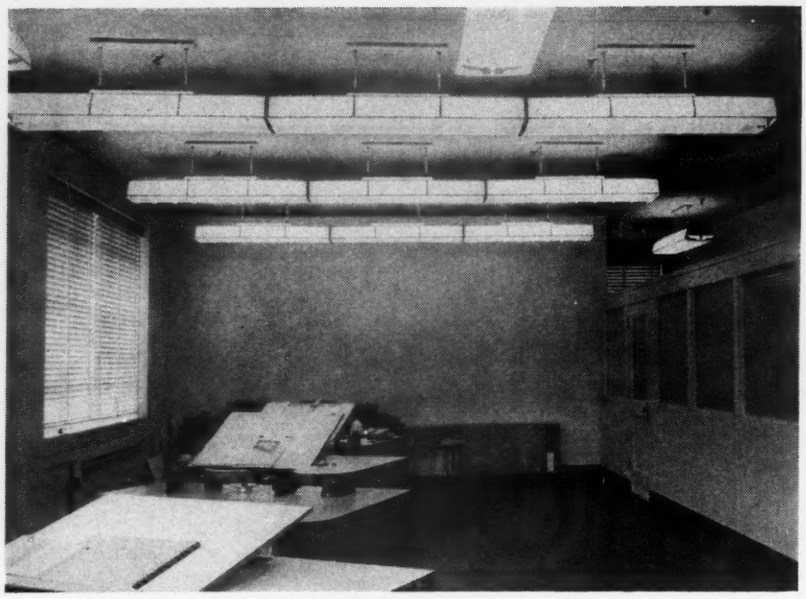
O.P.A. Retail Ceiling Price $11.00

Model 102 illustrated, 1320 watts Others in higher ratings

E. D. ROSE

SALES AGENT

11125 Lake Ave. Cleveland 2, Ohio



Continuous runs of suspended luminous light, light color treatment of walls and ceiling, drafting desks arranged obliquely to overhead fixtures and Venetian blinds over window areas combine to achieve high levels of shadowless, glareless illumination in this drafting room.

tracing cloth, the lighting must be of low surface brightness. To maintain drafting efficiency by eliminating sharp shadows from the edges of T-square, scales and triangles, the illumination must be highly diffuse. To further drawing accuracy by adequately showing the range of line intensities from the jet black of India ink to the faint, thin strokes of a hard, finely pointed pencil, the intensities of light on the working plane should exceed a minimum standard of 50 footcandles. The resultant objective, therefore, is threefold; including low surface brightness, high intensities and shadowless illumination.

This objective was achieved in the drafting room of the Plastics Division, General Electric Company, Pittsfield, Mass., by suspending continuous runs of fluorescent fixtures, employing a light tonal treatment in the room and arranging the drafting tables at a 30 degree angle to the lines of overhead light.

Wakefield General G-260 fixtures were suspended in runs spaced on 8-foot 6-inch centers, 9-feet 5-inches above the floor. The ceiling height is 11 feet. Each line of light contains three units holding two 100-watt Mazda FT-17 white fluorescent tubes with rated outputs of 4200 lumens for lives of 2000 hours. With a consumption per fixture of 232 watts (including ballast) and illuminated areas per fixture of 42.5 square feet, the resultant unit consumption is 5.46 watts per square foot. Side panels of white plastic emit general diffusion from the fixtures, direct light passes downward through the louvred bottoms and 70 percent of the upward lighting component is reflected from the medium brown Celotex paneled ceiling. A room index of .75 and a maintenance factor of .7 results in a utilization factor of .52 with an intensity of 73 footcandles on the drafting areas.

Although high general illumination eliminates all harsh and confusing shadows, the faint suggestion of light interception along T-square and triangle edges is further minimized by the oblique arrangement of desks. Light Venetian blinds over the windows baffle glare from direct outside light and reflect this supplemental illumination to the ceiling. The blinds have also proved beneficial at night by reflecting overhead light back into the working areas and preventing the dissipation of light through unshaded glass.

Speakers at the dinner meeting of the Illuminating Engineering Society's East Central Regional Conference, Philadelphia, Pa., on January 31 were (l. to r.): A. F. Wakefield, IES national President; A. H. Manwaring, Chairman, Philadelphia Section, IES, and dinner chairman; and A. A. Brainerd, East Central Region Vice President.

Curtis 70610-XE

DEFINITELY IN THE QUALITY CIRCLE

Designed

AND CONSTRUCTED TO CUSTOM-BUILT STANDARDS

The growing popularity of this excellent luminaire once again proves that quality merchandise attracts quality buyers! • The No. 70610-XE was originally designed and built for one installation that demanded "tops" in appearance and construction. • Now that it has become available as a standard item, the quality market has shown an amazing response. • If you want to get into the "quality circle"... the profitable business ...write for our specification sheet on the No. 70610-XE... today!

CURTIS *Lighting*, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

Our jobber tells you how...

● It's easy to pick the right capacitor replacement for that wornout unit. Your local Aerovox jobber has the latest data showing at a glance the Aerovox exact-duplicate or Aerovox universal replacement for a satisfactory job. Also, he carries a stock of motor capacitors for your convenience.

• Ask Our Jobber!

AEROVOX capacitors
FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS

AEROVOX CORP., NEW BEDFORD, MASS., U.S.A.
Export: 13 E. 40th St., New York 16, N.Y. • Cable: 'ARLAB'
In Canada: AEROVOX CANADA LTD., Hamilton, Ont.

TRAINING FOR HOUSE WIREMEN

[FROM PAGE 77]

Trade, is actually installed by the men taking the course. The modern wiring layout includes electric heaters in the bathroom, adequate number of convenience outlets, range and water heater circuits, outdoor receptacles, multiple-note door chimes, illuminated house number, and other "electrical living" features. This plan serves the dual purpose of teaching the student what adequate wiring means and also how to install it.

The students, under the guidance of the instructors, wire the complete house—drilling the holes for cables, mounting outlet boxes, pulling in cable, mounting load-centers, making all connections. After the course is completed, the wiring is taken out and the house rewired by the second group of students. To prepare the men for any eventuality, two wiring systems are taught—flexible armored cable (BX) and non-metallic sheathed cable (Romex). One-half of the house is wired with each system.

With the first "graduates" now awaiting assignment to contractors, a second group of 80 is registered for the second "semester" of the school on March 4. It is the plan of the Joint Apprenticeship Training Committee to repeat the school until a sufficient number of "residential journeymen" are trained to meet the demands of St. Louis' predicted housing boom this spring.

Members of the Committee representing the contractors are: Russell E. Vierheller, secretary-manager, St. Louis Chapter, NECA; Carl I. Schaeffer and E. L. Markland. Representing the Local No. 1, IBEW are: John T. Meinert, president; James A. Morrell, business manager; and Leo J. Hennessey, financial secretary.

Contractor Association manager Vierheller views the residential wiring school as another indication of labor-management accord in the electrical construction industry and the desire of both groups to serve the public as efficiently as possible. Local Union president Meinert sees in the school a direct contribution to public safety by providing skilled men to install residential wiring.

The way St. Louis contractors and the union have tackled technical training of residential wiremen is commendable and should set the pace for other contractor groups throughout the country.

This is the type of teamwork that will be required if the millions of vitally needed houses are to be built to the mutual benefit of all concerned.

To Help Busy Contractors Get MORE Work Done

Yes, Sherman Connectors are helping thousands of busy Electrical Contractors to get more work done. On every job where Sherman Connectors are used, you'll find that the work goes a little smoother and a little faster, because these connectors are specially designed for rapid, easy installation.

Wedge-Grip Connectors

Soldering Lugs for Every Requirement

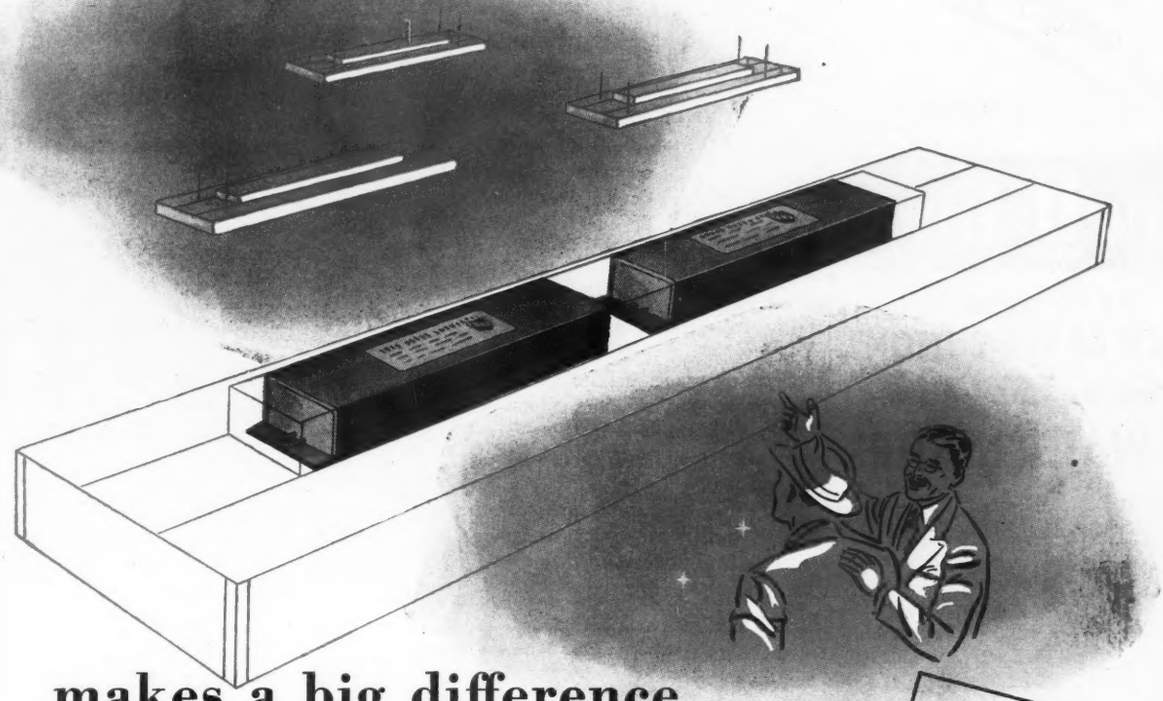
Sherman fittings likewise assure safe, dependable, permanent connections, thereby eliminating callbacks, and safeguarding the contractor's reputation for quality workmanship. Ask your wholesaler for Sherman Connectors.

H. B. Sherman Mfg. Co.
Battle Creek, Michigan

Solderless Lugs in a full range of sizes

Sherman
ELECTRICAL CONNECTORS

The thing you can't see...



makes a big difference in lighting performance!

Most *users* of fluorescent lighting fixtures aren't aware that things like ballasts exist. They're concerned with light-for-attraction and light-for-selling.

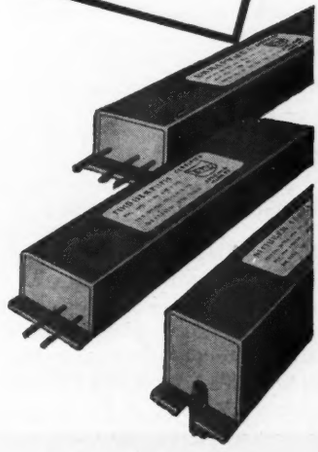
But the man who *sells* fluorescent lighting *is* aware. He's concerned with lighting performance and fixture operation. Most men who know lighting also know that CERTIFIED BALLASTS, the hidden heart of the fixture, assure satisfied customers . . . freedom from service worries.

What's the big difference? Just this:

CERTIFIED BALLASTS are built to exacting specifications set up by foremost lighting engineers. They are thoroughly tested and checked by impartial experts, Electrical Testing Laboratories, Inc., before they are CERTIFIED as meeting the specifications.

And leading fluorescent tube makers will guarantee lamp performance when CERTIFIED BALLASTS are specified in fixtures.

For new fixtures or for replacement in existing equipment, *remember the hidden difference* . . . specify CERTIFIED BALLASTS.



Certified Ballast Manufacturers

Makers of Certified Ballasts for Fluorescent Lighting Fixtures

CHICAGO TRANSFORMER CORP.
3501 Addison St., Chicago, Illinois

GENERAL ELECTRIC CO.
Specialty Transformer Division
1635 Broadway, Fort Wayne, Ind.

JEFFERSON ELECTRIC CO.
Bellwood, Illinois

SOLA ELECTRIC CO.
2525 Clybourn Ave., Chicago 14, Illinois

WHEELER INSULATED WIRE CO.
378 Washington Ave., Bridgeport, Conn.

an eager public

WANTS

Sav·U·time

PROVIDES

"TOUCH OF THE BUTTON"

Control for "Side-Arm"

GAS WATER HEATERS

Hot water at the touch of a button—in bathroom, kitchen or laundry—from her present side arm gas water heater. That's what SAV-U-TIME offers the housewife. Liberal profit for you.

Sav-U-time

RETAILS FOR

$39.50 plus installation

SAV-U-TIME is quickly installed on manually operated gas water heaters. A touch of the button, turns it on—providing hot water when wanted—without running down and up stairs. Saves time—saves gas.

IMMEDIATE DELIVERY—You can get SAV-U-TIME right now. Make sales and collect your profits now.

DEALERSHIPS AVAILABLE—Be the SAV-U-TIME dealer in your community and get in on this profitable market. National advertising, direct mail and point of sale displays help you sell SAV-U-TIME. WRITE NOW.

SAV-U-TIME SALES COMPANY

70 MANHATTAN ST., ROCHESTER 2, N. Y.

G.I. SKILL CREDITS

[FROM PAGE 78]

Most veterans interviewed agreed that it would be unfair to them and the prospective employers (or to the public whom they intend to serve directly or indirectly) if the industry and authority in charge were to assume or allow for qualifications, or experience, which in fact cannot be justified as a credit toward established trade requirements.

Although the committee acknowledged that length of service would not necessarily broaden the electrical knowledge of veterans, it is believed that a man could become more proficient in his particular specialized field. The committee also felt that the ingenuity and service records of electricians in the Navy Construction Batallions (Seabees) warrants extra consideration—primarily because electricians in the Seabees were generally men with previous electrical experience.

The following table presents the suggested credits for length of service, *such credits to be added to those granted for special schooling:*

Credits for Electrical Ratings Based on Length of Service

Service Rating	Credit « Per Month of Service Applied toward	
	State License	Apprentice Training
3rd Class Electrician, U. S. Navy	5 days	40 hours
2nd Class Electrician, U. S. Navy	10 days	80 hours
1st Class Electrician, U. S. Navy	15 days	120 hours
Chief Electrician's Mate, U. S. Navy	20 days	160 hours
Radio, Radar or other Electrical Technicians—U. S. Army or Coast Guard	5 days	40 hours

Based on information given in the U. S. War Manpower Commission Guides for placing Navy or Military personnel in civilian occupations, the above credits for experience gained while in the U. S. Armed Services are generous when applied to the requirements for electrical journeymen under the Minnesota State Licensing Law and the apprenticeship training system.

It must be recognized that no hard and fast rules can be set forth because there may be occasional—perhaps rare—cases where electrical experience gained in service will approach, if not equal, the types of general experience which the man would have gained as an electrician in civilian work.

The fact that returning veterans must have some training before they can become the type of electrician needed in the electrical construction industry is illustrated by the following list of electrical techniques or processes generally required in the Minnesota area to round out an apprentice wireman's training before he can become a qualified journeyman electrician:

What Qualified Journeymen Electricians Must Do

1. House Wiring Installations
2. Farmstead Wiring Installations
3. Office Building Installations
4. Conduit Work—Rigid and Thin Wall—concealed
5. Conduit Work—Rigid and Thin Wall—exposed
6. Metal Moulding and Raceways
7. General Wiring—Additions and Remodeling

*8. Maintenance of Electrical Equipment and Systems

*9. Motor Trouble Shooting and Repairs

*10. Power Wiring for Motors.

11. Lighting Fixture Installations—all types
12. Sign Wiring, Hanging and Servicing
13. Underground work, Parking Lot and Street Lighting.

*14. Telephone and Sound System Installations

15. Wiring of Hazardous Locations

*16. Installing Electronic Controls and Equipment

17. Unclassified or Miscellaneous Electrical Work

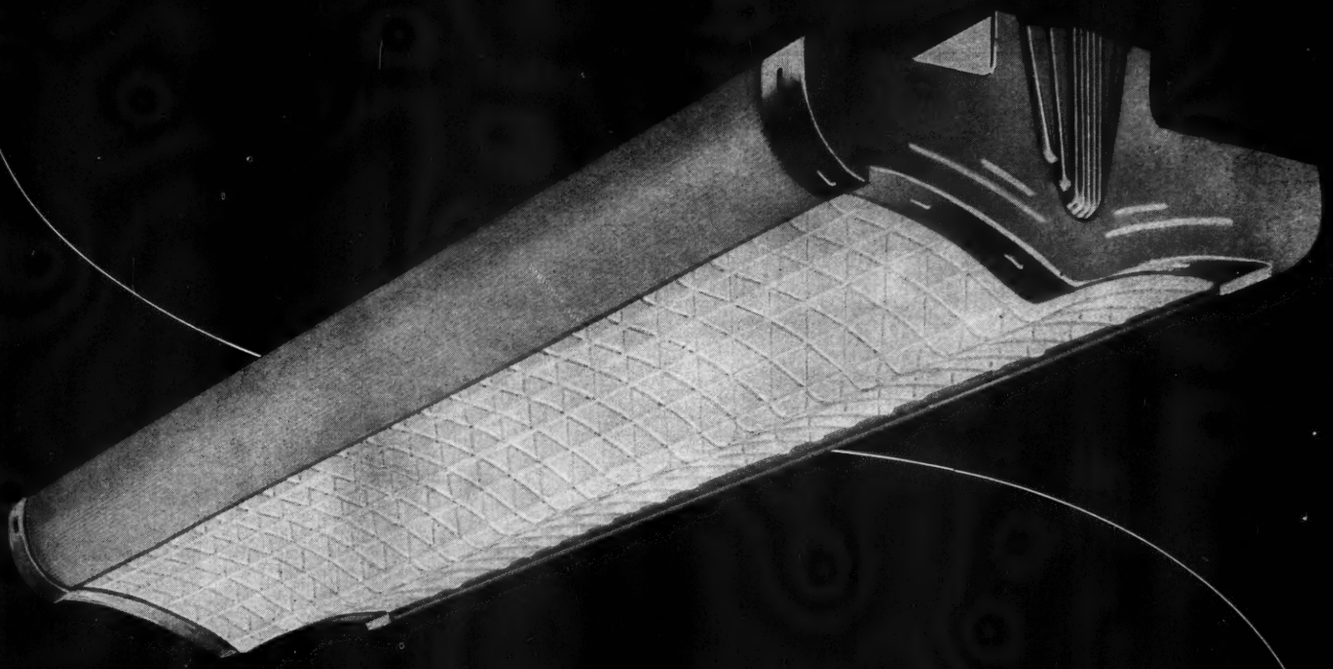
Note: Items marked (*) are those processes in which electricians in the Armed Services may have had specific experience.

The Joint Industry Committee believes that despite intensive schooling and experience in these limited classes of electrical work, some limitation should be placed on the total credit given a Veteran for length of service—perhaps not over two years. He must still gain considerable experience in those other processes which make a journeyman a qualified "all-around" electrician.

Considerable thought and study has been given this subject of veteran credit by the Joint Industry Committee in Minnesota. The Veteran's training and experience while in service has been carefully weighed against the over-all experience needed in civilian electrical work. Only by following such a set of basic credits will the veteran, his employer and the public he serves be spared the embarrassment of judging a man's ability on assumed qualifications.

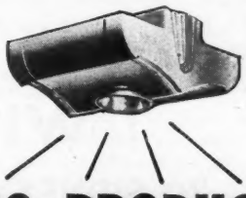
Members of the Joint Industry Committee representing the Minnesota Electrical Council, Inc., are: D. F. Kehne, St. Paul, chairman; O. H. Batzli, Minneapolis; E. G. Nylund, Duluth; E. W. Linner, Stillwater; and W. A. Ritt, St. Peter. Representing the Minnesota Electrical Workers Council are: Claude Skeldon, Minneapolis; Charles Brett, St. Paul; and Charles Lyons, Duluth. Glenn Rowell and S. Martin Streed of Minneapolis were the Minnesota Electrical Inspectors Association members on the committee.

Constellation



by Lighting Products

THE New Constellation, Series 110, for 2-40 and 4-40 watt fluorescent lamps may be had either louvered or all glass enclosed. Also available are SPOT-O-LITE units for end or between fixture mounting. Look to Lighting Products for the best that's new in lighting.



LIGHTING PRODUCTS, INC.

HIGHLAND PARK • ILLINOIS

This is the kind of a job that TIREX cables are designed to do satisfactorily. Here is a picture of a cable taking real punishment. Mud, snow, water and abuse, — all of these factors are present and through it all TIREX keeps right on with its unfailing dependability to deliver the current that keeps vital construction machines in operation. TIREX is not sold on a "it must be pampered" basis. TIREX cables take all the tough jobs right in their stride and then ask for more.

The Selenium Rubber Armor which protects the conductors of all TIREX cables is the toughest, most wear-resistant jacket known for wires and cables. The next time you need portable cords or cables that can be depended on be sure you specify TIREX.

TIREX SELENIUM Rubber Armor

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

The Electronic Adjustable Speed Drive

By Harold J. Hague
Electronic Application Engineer
Westinghouse Electric Corporation
East Pittsburgh, Pa

Many schemes have been proposed for obtaining the characteristics of the direct current motor when the power available for operation of the drive is alternating current; some involved the modification of the alternating current motor, others involved the use of the conventional m-g set to convert alternating current to direct current and hence drive a direct current motor. However, the standard direct current motor does not completely fulfill all of the requirements of wide speed range, good speed regulation, and smooth, automatic acceleration. The most satisfactory means for obtaining these rigorous characteristics is the electronically controlled direct current motor which takes power from an alternating current power supply.

The heart of the drive is the electronic rectifier for the motor and its allied control circuits. Without belts, external regulators, or gearing, it provides wide, stepless speed range with finger tip control; close, automatic acceleration at all speeds and loading variations; stable operation at all speeds and loading variations; protection against overload, low voltage and field failure; without creating excessive current peaks permits reversing and dynamic braking.

A complete alternating current adjustable-speed electronic drive is comprised of four pieces of equipment as illustrated in Figure 1.

(1) Anode Power Transformer: The anode power transformer supplies the proper voltage to the rectifier tubes. Figure 1 shows the transformer as being single phase. The anode power transformer may be of any practical frequency, primary voltage and phase; however, for purposes of standardization, the transformer is designed for single phase operation for two horsepower and below and for three phase operation for three horsepower and above.

(2) Control Cabinet: The control cabinet houses the tubes and accessories required for successful operation of the system.

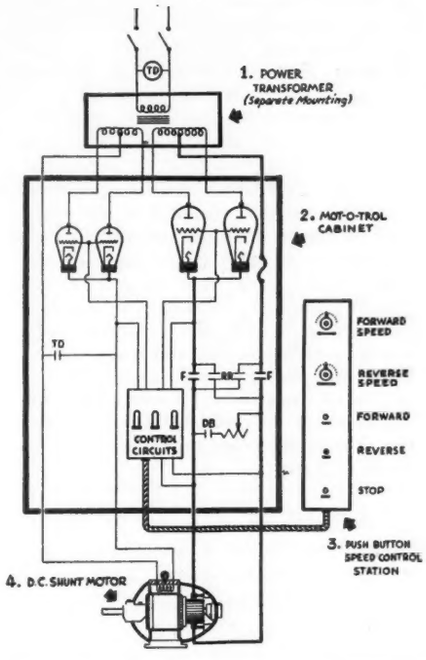


FIG. 1—Line diagram showing the four basic components used to make up the electronic adjustable speed drive. The incoming alternating current power is converted to direct current by the Thyratron rectifier tubes. The tubes supply the direct current to the armature and field circuits of the direct current driving motor. A potentiometer in the control station varies the voltage of the rectified direct current supplied to both armature and field circuits by shifting the phase of the grid control voltage of the rectifier tubes. Both armature and field circuits (controlling the entire speed range) can be controlled by the one dial on the control station.

(3) Operator's Control Station: The control station contains the pushbuttons used for starting, stopping, and reversing the drive and the speed control dials.

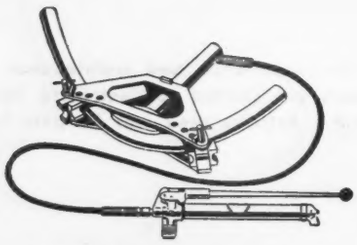
(4) Direct Current Shunt Wound Motor: The motor is of shunt wound construction and can be of open or enclosed construction and with sleeve or ball bearing.

The rectifier power supply can be said to consist of the anode power transformer and the electronic control units. The number of rectified phases depends upon the most economical arrangement of available Thyratron tubes required to handle the rating. When the drive is operated from single phase power lines, the rectifier is usually of the so-called single phase full wave design. When the drive is operated from three phase, one of the polyphase rectifier systems is usually employed.

Operating Characteristics

Starting: The electronic adjustable speed drive is so designed that the motor is always started with full field, regardless of the setting of the speed control dial or potentiometer. If the speed control dial is set so that the motor is to operate in the weakened field range, the portion of the control that is used to weaken the field does not become effective until the motor reaches its base speed.

Current Limitation: Fast, smooth acceleration is automatically obtained by incorporating a current limiting circuit. The current limiting circuit controls the rectifier tubes when the preset current is reached in such a manner that the preset current limit is not exceeded. The current limiting feature provides smooth operation of the driven machine by eliminating shock loads during starting and by giving a definite maximum torque during the accelerating period.



When you buy a

BENDER

..check to make sure you get these features:

EASY TO GET TO THE JOB

☑ Lightweight, portable—one man can easily take a Blackhawk Pipe Bender right to the job. Bends rigid conduit and pipe in all popular sizes, up to 4" dia.

WORKS AT ALL ANGLES

☑ The compact hydraulic Porto-Power Ram is all-directional. Power eliminates need for heating the pipe.

WORK OVERHEAD

☑ All-directional operation and light weight enlarges range of utility to use on ladders, scaffolds and cramped quarters and work on existing pipe runs.

SIGHT FROM ANY ANGLE

☑ Remote control permits operator to stand in any position for a full view of the job. Saves need for elbows, couplings, cutting and extra threading.

DETACHABLE POWER UNIT FOR EXTRA UTILITY

☑ It pulls gears, lifts machinery, and licks scores of other trouble jobs.

BLACKHAWK Porto-Power PIPE BENDERS

BLACKHAWK MFG. CO.
Dept. P 2056 Milwaukee 1, Wis.
Mail Hydraulic Equipment catalog to:

NAME_____

COMPANY_____

ADDRESS_____

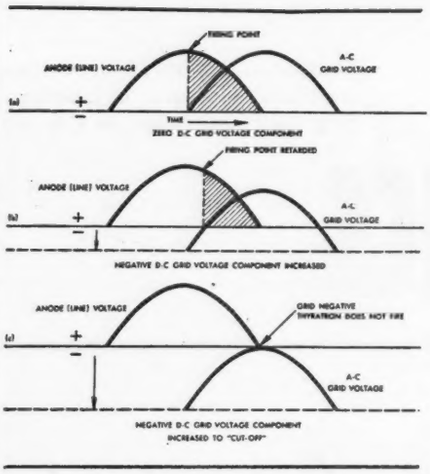


FIG. 2—All of the speed adjustment and speed regulation functions (exclusive of field weakening) either manual or automatic, as well as the current limitation, are accomplished by varying the motor armature voltage. This varying armature voltage is obtained by advancing the firing point of the rectifier tubes on the voltage wave, thus permitting only a certain portion of the alternating current voltage wave to be rectified into undirectional voltage. From the top figure (a) it can be seen that an alternating current voltage (supplied from a small grid transformer) is applied to the rectifier tube grid, 90 degrees lagging the anode (or line) voltage. In addition, a variable negative direct current voltage component is applied to the same grid. When the direct current voltage component is zero, an advance in the firing angle of the rectifier tube is obtained, as shown by the cross hatched area. Thus, a high direct current voltage is supplied to the motor armature. When the direct current component is increased negatively, (b and c) the firing angle is delayed still further until the voltage supplied to the motor armature is zero.

Manual Speed Adjustment: Manual speed adjustments are obtained by means of a small potentiometer. Changing the setting of the potentiometer alters the direct current component voltage to the Thyratron grids and thereby varies the rectified voltage to the motor armature from maximum to minimum. Practically an indefinite number of steps are available to provide adjustment over the speed range, and the control can be preset for any desired speed, or the speed can be varied while the motor is running.

Speed Range and Automatic Speed Regulation: The negative direct current component of the rectifier grid bias voltage is automatically increased or decreased by the operation of other small control tubes and their allied circuits, as the speed of the motor varies from the pre-selected speed as shown in Figure 2. The operation of the speed regulating circuit is much the same as described for the manual adjustment. The component circuits are balanced in such a manner that the rectifier tubes furnish the proper output voltage to the motor armature to maintain the pre-selected value of speed.

Fundamentally the electronic adjustable speed drive provides constant torque below the base speed of the motor, and above the base speed of the motor the drive provides constant horsepower as illustrated in Figure 3. The constant torque range being obtained by means of variations in the armature voltage and the constant horsepower range is obtained by weakening the field of the motor.

The normal speed range by means of the armature control is 20 to 1, however, in certain cases this has been extended considerably beyond this range. One application is on file in which the speed range is 100 to 1 by means of armature control. Due to the mechanical construction of the motor, the field control range is usually 2 to 1. However, if the motor can handle the higher speeds with the weakened field, this range can be extended. The top limit of the speed is, therefore, the mechanical limitations of the motor.

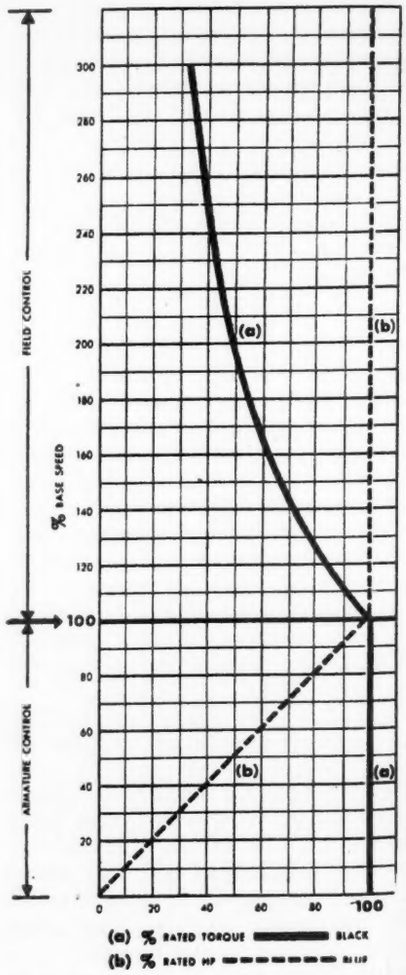


FIG. 3—Torque and horsepower characteristics of the electronic adjustable speed drive over a wide range of speed.

TRUMBULL

ISOLATION OF CONTROL

.. for Safety - Economy

Motors and/or other current consuming apparatus . . . with lock-type push button stations . . . of appropriate design . . . for areas in which such equipment is located . . . with Control Center at an isolated location . . . may be one answer to your electrical problem.

Many industrial atmospheres are enemies of electrical control apparatus. The presence of dirt, dust, vapors, moisture, etc., may make it advisable to consider the location of only a minimum amount of control equipment in your actual working areas. Motors . . . YES; Push buttons for start and stop of such motors . . . YES; but actual Control, Disconnect, Short Circuit and Over-Current Protection . . . NO. These functions can be located AWAY from actual working areas, where apparatus can be installed without sacrifice of productive square feet . . . and where maintenance and inspection are facilitated.

In other words, Trumbull will take your safety switches, circuit breakers, controllers and main bus bar structures . . . wrap them up in Steel . . . and build you a Control Center to be located *away* from *trouble.*

Diagram above shows Production Area containing only motors and push button stations. Removed from troublesome atmospheres, the Control Center is Guardian of the whole situation.

THE TRUMBULL ELECTRIC MANUFACTURING CO.

PLAINVILLE, CONNECTICUT

OTHER FACTORIES AT

NORWOOD, OHIO — LOS ANGELES — SAN FRANCISCO — SEATTLE

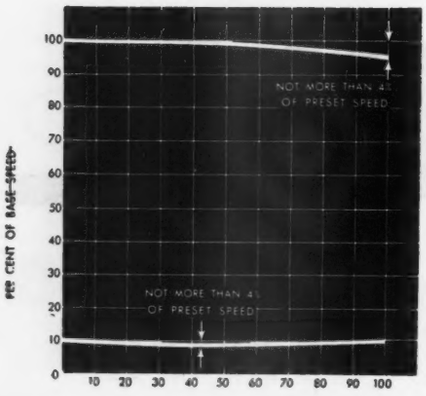


FIG. 4—With optimum speed compensation set for a 10 to 1 speed range, Mot-O-Trol limits regulation to within four percent for any speed setting within this range.

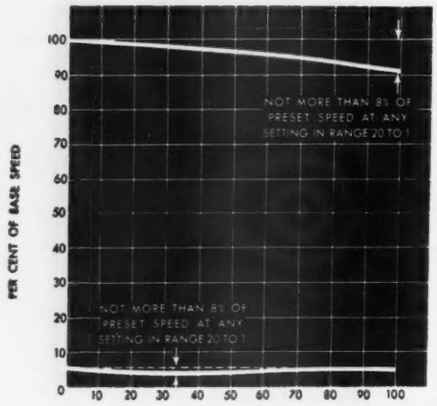


FIG. 5—Speed regulation obtainable with Mot-O-Trol when speed compensation has an optimum adjustment for a speed range of 20 to 1. Maximum speed regulation eight percent for any speed setting within this range.

The standard electronic adjustable speed drive automatically regulates the motor in such a manner as to maintain essentially constant speed at any setting regardless of the variations in load. In a system that is properly adjusted the regulation should not exceed four percent from a preset setting varying from no load to full load when operating over a 10 to 1 range in speed (Figure 4). When operating over a 20 to 1 range in speed, the variations in speed should not exceed eight percent. (Figure 5)

Dynamic Braking: The motor is quickly stopped by means of a dynamic braking resistor that is inserted across the motor armature during the deceleration period. The amount of dynamic braking is adjustable and the braking resistor is placed across the motor armature circuit by closing the back contacts on the motor armature contactor when the motor armature contacts are opened.

Reversing and Inching: Reversing contactors can be included in the main control cabinet without increasing the cabinet dimensions. By the addition of the proper relays in the control cabinet and pushbuttons to the control station, inch-forward or inch-reverse service can be added to the drive. Inching or reversing can be done at any preset speed (within the speed range of the unit) or, it preferred, inching or reversing can be at one fixed speed. In the latter case, a speed control dial is not required for inching.

Overloads: To guard against too great an overload on the rectifier tubes and to obtain the most desirable accelerating torques, the current limit circuit is used. In most practical cases the drive is designed so the current limit can be adjusted up to between 1.8 to 2.5 times the rated armature current of the motor; however, for the majority of applications, the current limit is usually set for twice the rated armature current. The above limits will permit a starting torque of approximately two hundred percent and a pull-out torque of approximately 150 to 160 percent. The current limit also protects the machine and its accessories by lessened starting-shock loads and permits smoother overall operation.

An initial five minute time-delay relay protects the Thyratron tubes from damage due to operation before the tubes have had sufficient time to warm up.

In addition to a current limiting feature and time delay relay, the adjustable electronic speed drive is equipped with conventional overload relay and fuses in the armature circuit.

Efficiency: Where single-phase rectification is used, the overall efficiency from alternating current line to direct current motor output is 50 percent or greater at full rated speed. On units where multiphase rectification is the standard design, efficiency is 60 percent or greater. Although these values may appear to be low, it should be remembered that the conventional variable voltage system employing a motor generator set has an efficiency of approximately 40 to 50 percent when the system consists of the alternating current motor, generator and exciter, together with the field rheostats and direct current motor. Also, it should be recognized that where the advantages and features of the electronic drive are desired, efficiency is usually a secondary consideration to functional performance.

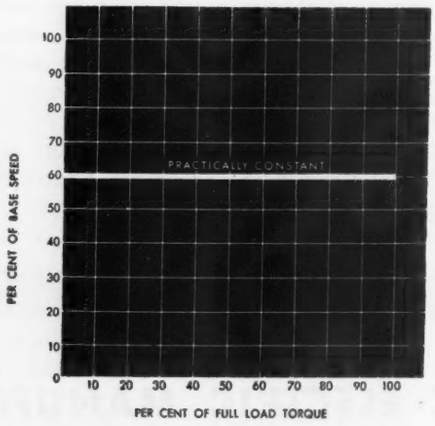


FIG. 6—This practically flat regulation, from zero to maximum torque is obtainable with compensation adjusted for any particular speed within the operating range.

FIG. 7—The author operating an electronic adjustable speed drive demonstrator. A tachometer generator, coupled to the drive motor is used to furnish a means for indicating the speed while a meter is placed in the motor armature circuit to demonstrate the advantage of current limit feature and indicate the load on motor.

Features of the electronic adjustable drive can be summarized as follows:

Wide-range, stepless variable speed control. The speed can be varied while the motor is running by means of a small speed control dial.

Close automatic speed regulation at all speeds and loading variations.

Smooth, automatic acceleration. Current limit to suit load requirements.

Finger-tip speed control on one dial.

Protection against overload, low voltage and field failure.

Starting of the motor with full field.

Motor stopped by dynamic braking.

Stable operation with full torque at low speeds.

Constant torque from minimum to base speed.

Constant horsepower from base speed to higher speeds.

Fewer rotating parts and hence minimum vibration.

Equipment ideally suited in setting up an automatic sequence of operation.

Utilization of a-c eliminates need for separate d-c source of power.

The control can be enclosed or mounted as an integral part of the machine.

THE SAFE WAY TO MEASURE VALUE IN INDUSTRIAL LIGHTING EQUIPMENT

The basic idea behind every activity of RLM Standards Institute . . . and the use of the RLM LABEL to identify industrial lighting equipment certified by the Institute . . . is to protect the user.

Every industrial lighting unit qualified to bear the RLM LABEL must conform to rigid RLM Official Standard Specifications. These specifications cover construction and performance factors vital to safety, lighting efficiency and economy. Serving as a certificate of performance to these specifications, *certified by an independent testing laboratory,* the RLM LABEL is an outward sign of inner value.

That is why it is so worthwhile to look for the RLM LABEL when buying Incandescent and Fluorescent industrial lighting equipment.

Copies of all RLM Specifications may be secured through any manufacturer utilizing RLM inspection and certification, or direct from RLM Standards Institute.

Manufacturers Participating In RLM CERTIFICATION PROGRAM

BENJAMIN ELECTRIC MFG. COMPANY
Des Plaines, Illinois
BRIGHT LIGHT REFLECTOR CO., INC.
Bridgeport, Connecticut
GOODRICH ELECTRIC COMPANY
Chicago, Illinois
JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio
THE MILLER COMPANY
Meriden, Connecticut
MITCHELL MANUFACTURING CO.
Chicago, Illinois
OVERBAGH & AYRES MFG. COMPANY
Chicago, Illinois
QUADRANGLE MANUFACTURING CO.
Chicago, Illinois
SMOOT-HOLMAN COMPANY
Inglewood, California
WESTINGHOUSE ELECTRIC CORP.
Cleveland, Ohio
WHEELER REFLECTOR COMPANY
Boston, Massachusetts

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

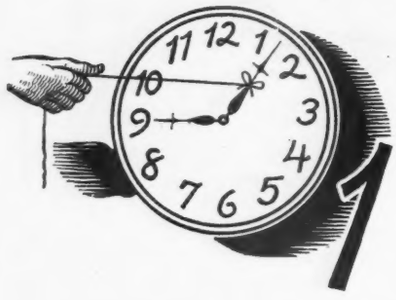
RLM STANDARDS INSTITUTE
INCORPORATED
307 N. MICHIGAN AVE. SUITE 420 CHICAGO 1, ILL.

Trion - the smart fuse

DUAL-ELEMENT, TRIPLE PROTECTION

It Adds Up!

Its lower watt loss (heat loss) makes a Trion the coolest operating fuse of any type. Trion's substantially lower heat ceiling prevents excessive temperature, whether accumulated from load or surrounding air. The tripping temperature of a Trion provides a heat ceiling 500° F lower than that of any zinc link fuse.



Because of its patented contact release and movable contact (Therm-A-Trip), a Trion has the longest safe time-lag of any overload protective device, whether fuse or circuit breaker.

A Trion blows instantly on short circuit; and in doing so, also controls the rate of rise in recovery voltage—a further safeguard.

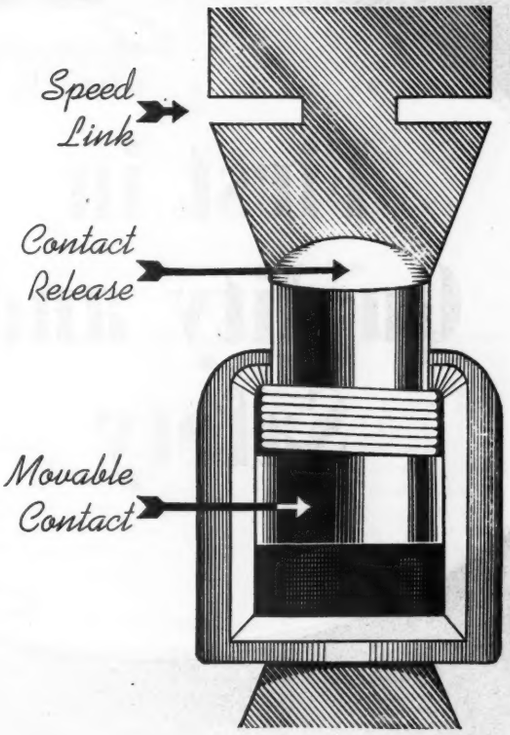
All this adds up to triple protection, found only in Trion, the smart fuse!

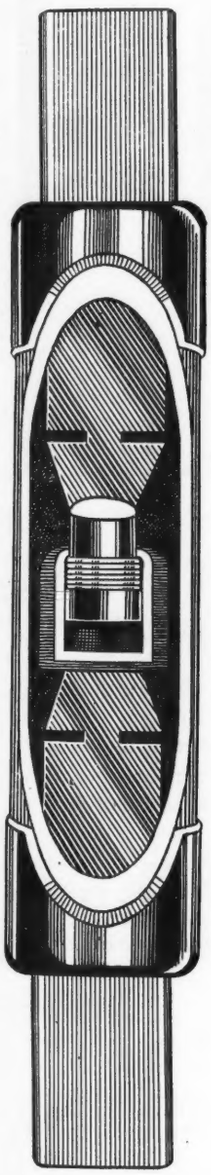
The Chase-Shawmut Company

Boston New York Syracuse Philadelphia Baltimore Atlanta Detroit Columbus New Orleans Indianapolis

The 3-in-1 fuse with Therm-A-Trip

How it works —





When a short circuit occurs, one or more of the necks of the Speed Link are blown, instantaneously opening the circuit, and preventing damage to wiring or equipment.

Trion's Therm-A-Trip also opens the circuit when safe operating temperatures, whether surrounding or load, are exceeded. It matches its thermal capacity to the motor or transformer it protects.

When a safe overload is exceeded, the Therm-A-Trip, with its Contact Release and Movable Contact, absorbs heat, giving an extra long time-delay. Then the Contact Release melts, and the Movable Contact, driven by its heavy spring, opens the circuit with the efficiency of a circuit breaker.

Fuse economy with circuit breaker efficiency

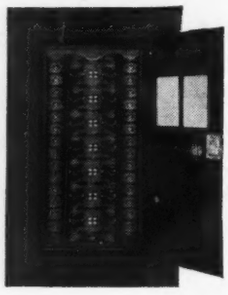
Newburyport, Massachusetts

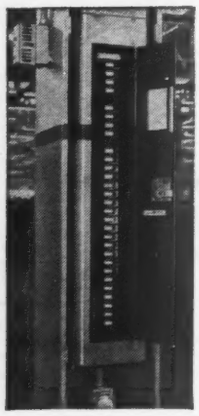
Chicago Dallas St. Louis Omaha Kansas City Denver Los Angeles San Francisco Seattle Minneapolis

First in Quality and Safety

BULLDOG *SUPERBA* AND *CIRCUIT MASTER* PANELBOARDS

Superba Lighting Panelboards comprised of symmetrically designed bakelite units incorporate more improved operating and safety features, greater flexibility for all wiring systems and finer appearance than is procurable in any other Panelboard. Available in panel sizes ranging from 4 to 40 circuits.





Narrow Column Type Circuit Master (circuit breaker) Panels 8½" wide or less for installing between the flanges of H columns . . . saves usable working space. Special design features simplify installation problems, cut wiring time and reduce wire and conduit runs. Available in panel sizes from 6 to 32 circuits.

BULLDOG *Vacu-Break* SAFETY SWITCHES WITH "CLAMPMATIC" CONTACTS

As industry reconverts to competitive peacetime production, manufacturers—large and small—are insisting on the best circuit protective devices available *to keep power on the job.*

That's why the demand for BullDog Vacu-Break Safety Switches with "Clampmatic" Contacts has now reached a new all time high.

First in the field — in quality and safety — the many advanced and exclusive features of these BullDog switches will help you speed production and reduce maintenance costs by carrying your loads more safely and efficiently.

BETTER FOUR WAYS

1. Formed "Bakelite Arcing Chambers" confine and suffocate arcs . . . prevent burning and pitting of Contacts.
2. "Clampmatic" feature assures contacts tight as a bolted connection . . . reduces heating under continuous loads.
3. Quick action mechanism assures positive "ON" and "OFF" operation.
4. Attractive, modern cabinets with ample wiring room—yet compact. Equipped with Solderless Wire Grips.

BULLDOG

Detroit 32, Michigan. In Canada: BullDog Electric Products of Canada, Ltd., Toronto. Field Offices in All Principal Cities.

Also Manufacturers of Circuit Master Breakers — SafToFuse Panelboards—BUStribution Duct, for "plug-in" power—Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for moving "loads."

BULLDOG ELECTRIC PRODUCTS CO.

Keep Up-to-date on new Developments

through this FREE SERVICE . . . . . .

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

FACSIMILE COMMUNICATION

1 Folder discussing uses and advantages of point-to-point mobile or stationary facsimile communication of writing, pictures or printed matter by either wire or radio. Finch Telecommunications, Inc.

OUTLETS

2 Hanger Outlets and Floor Boxes, AIA File 31-C-72, discusses wall outlets for fans, special lighting and radio cones; adjustable floor boxes, hand hole and signal floor boxes. Frank Adam Electric Co.

HOME WIRING GUIDE

3 "Electrical Modernization" illustrates and discusses present day wiring, the weaknesses and limitations of many systems, recommended improvements, advantages and convenience of such improvements, wiring layouts from service entrance to outlets and fixtures. Summary of required outlets and approved wiring materials are listed. Appliance and Merchandise Department, General Electric Co.

SYNTHETICS

4 "Synthetics for the Electrical Industry" discusses plastics, textiles and chemicals including films, foils, sheets, molding materials, yarns and fabrics. Index lists product, description and uses. Mechanical and electrical properties are tabulated. Celanese Corporation of America.

CONTROLS

5 A condensed general catalog discusses electrical control apparatus and includes enclosed safety switches, industrial circuit breakers, service entrance equipment, motor starters, switches and switchboards, bus bars, infra-red ovens and farm production equipment. Trumbull Electric Mfg. Co.

UNIT POWER PLANTS

6 Both a-c and d-c generating plants from 500-watt to 40 kw. capacity are discussed in 8-page folder. Electric service recommended for ranches, tourist camps, filling stations and farms for operating floodlights, radios, electric signs, tools and general use. Kato Engineering Co.

CONNECTORS

7 New catalog contains 184 pages of detailed technical data on brass connectors. Dimensions, shipping weights, formulae, tables and cross-indexed reference are features. Desk size, the book measures 9 by 11 inches. Anderson Brass Works Inc.

PREFORMED ARMOR RODS

8 "Preformed Armor Rods and Multiple Wire Ties" discusses purpose and types of conductor reinforcement and tieing, the contributory factors to short life, the history and development of preformed rods, the method of application, the advantages derived through their use and specifications. American Steel and Wire Co.

LAG LINK FUSES

9 Pamphlet titled "Lag but Balanced" tells why lag links were developed, how they function and how they are constructed. Pierce Renewable Fuses, Inc.

THEATRE LAMPS

10 Illustrated 32-page booklet on theatre lamps is for theatre operators, engineers and technicians, architects and decorators who are interested in proper use of light in theatres. Incandescent and fluorescent lamps, spots and floods for interior and marquee use are illustrated with numerous pencil renderings. Lobby, foyer, posters, ticket booth and heavy traffic areas are considered. Black light and sterilamps also included. Booklet listed as A-575. Lamp Division, Westinghouse Electric Corporation.

LOW RESISTANCE

11 Measuring low resistance outlined in bulletin 1805 presenting three different types of instruments for this purpose. Electrical engineers and maintenance men in shop and laboratories should be interested. James G. Biddle Co.

INFRA-RED APPLICATION

12 "Infra-red Parade" includes reconversion tips, war time "know how" and "now it can be told" tales, methods for better heat processing and reports on installations in use. Processes used advantageously in metal working, plastics, leather, textiles, food, rubber, glass, ceramics, printing, foundries and electrical plants. The Fostoria Pressed Steel Corp.

RESISTORS AND RHEOSTATS

13 New 16-page booklet titled "The Electronics Distributor" is exclu-

Circle numbers, sign and paste on your letterhead and mail in an envelope.

ELECTRICAL CONTRACTING **May**
330 West 42nd St.
New York, 18, N. Y. **(Not good after July 1)**

Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.

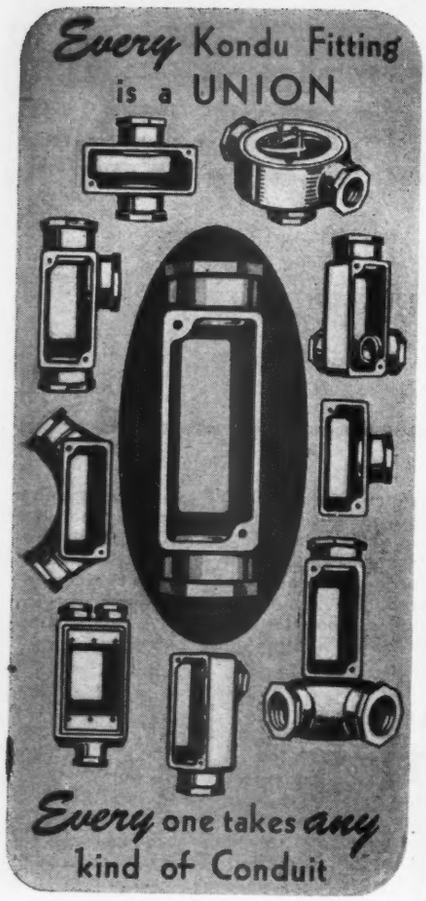
1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63							

NAME..... TITLE.....

COMPANY .....

ADDRESS .....

CITY..... STATE.....



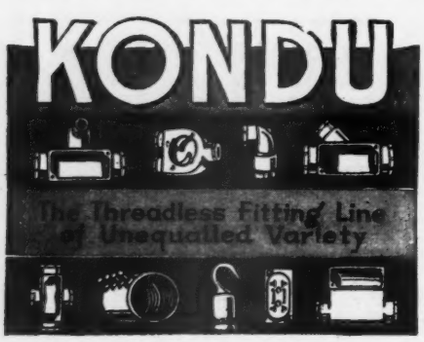
Only with Kondu can you take one fitting out of the line and put in another, without disturbing conduit . . . **only with Kondu** can you put up a conduit line before the fittings are delivered . . . because *every Kondu Fitting is a union.*

Only with Kondu can you use either standard conduit or thin-wall tubing, at any outlet of any fitting. Just slip out one bushing and slip in another . . . no extra pieces are needed.

Kondu fittings hold permanently tight . . . are vibration-proof. Practically unbreakable . . . 100% re-usable. Self-aligning. Roomy enough for all splices. *Write for the Kondu Catalog.*

KONDU CORPORATION
Erie, Pa.

KONDU MFG. CO. LTD., Preston, Ontario



sively compiled for the electronics industries. It gives complete data on wire-wound vitreous enameled resistors used in radio, television, radar and other related fields. Called D-2, it contains numerous charts, tables and formulae presented for rapid reference. Ward Leonard Electric Co.

LAMPS AND ACCESSORIES

14 Catalog for 1946 presents data on comprehensive variety of lamps, starters, fuses and batteries. Lamps include incandescents, fluorescents, heat, germicidal and special purpose units. Solar Electric Corp.

SWITCHBREAKER

15 Booklet thoroughly describes switchbreaker as to advantages, construction, operation, safety features and application. Code Electric Products Corp.

RADIO RECEIVER

16 Description, specifications, service data, parts list and wiring diagrams of models H-125 and H-126 a-c, d-c superhetrodyne receiver is contained in 8-page pamphlet. This brightly cased (gold with green or ivory), small (6 by 6 by 9¼-inches) radio has performance of larger sets. Westinghouse Electric Corp.

CHIMES

17 Door chimes, manually operated and without batteries, transformer or any wiring, presented for home, apartment or hotel owners. Description and sketches included. Authotone bulletin No. 110. Auth Electrical Specialty Co., Inc.

RELAYS

18 Bulletin 130 contains diagrams, pictures, specifications and uses for complete line of heavy duty relays. Ward Leonard Electric Co.

BATTERY CHARGING

19 Six-page folder No. 205 concerns multiple-circuit battery chargers for motorized hand-lift trucks. Illustrations and text cover advantages, design, controls and applications. The Electric Products Co.

AIRPORT EQUIPMENT

20 Airport Electrical Equipment is 56-page book including equipment and approved plans for airport lighting projects from Class 1 (all-way turf fields) to Class 5 (paved runways) installations. All types of distribution, lighting and associated equipment is pictured, specified and discussed. All designs meet CAA and AN standards. Westinghouse Electric Corp.

FLUORESCENT STRIPS

21 Four-page folder presents continuous, plug-in, all purpose Unite-a-Lite fluorescent fixtures (single tube, 20 or 40-watt) recommended for homes, stores, shops, offices and schools. Moe-Bridges Corp.

LENSES

22 Catalog AWP 21 covers all types of welders' and industrial safety lenses for chipping and grinding operations. Photographs and specifications augment text. Eastern Equipment Co., Inc.

HEATING COILS

23 Catalog titled "Heating Coils for Electrical Service and Repair" lists replacement heating coils for ranges, table stoves, hot plates, toasters and electric irons. Sketches supplement specifications. H. W. Tuttle and Co.

INSULATION GUIDE

24 Insulation Guide Book presents details and prices of insulating tapes, papers, sleeving, cloth, fibre and mica. Mitchell-Rand Insulating Co.

SIGNALLING DEVICES

25 A 50 page catalog covering line of signalling devices. Departmentalized for easy usage, with sections on bells, buzzers, horns, sirens, annunciators, burglar alarm devices and apartment systems. Partrick & Wilkins Co.

PANELBOARDS & SWITCHBOARDS

26 A 36 page catalog illustrating and describing this line of panelboards and switchboards. Kinney Electrical Mfg. Company.

SYNCHRONOUS MOTORS

27 Folder No. FF-11 describes and illustrates eight of the economies and operating advantages gained by use of synchronous motors engineered to large, constant-speed industrial applications. Electric Machinery Mfg. Company.

VARIABLE RECTIFIER

28 A new bulletin featuring rectifiers —selenium or tubes for d-c power requirements. Data pertains especially to single unit, double unit, and custom built rectifiers for electro-chemical applications. Richardson-Allen Corp.

ELECTRONICS

29 A new 8 page booklet, EBR-28, describes the ways in which electronics can be used in education. It is illustrated with charts, pictures of electronic equipment and actual scenes of the use of electronics for educational purposes. General Electric Company.

VINYLITE PLASTICS

30 A 20 page booklet discussing molding and extrusion compounds, flexible sheeting and film, cloth coating compounds and describes the properties of the Elastomeric compounds. Bakelite Corporation.

CONSTANT VOLTAGE TRANSFORMER

31 Bulletin JCV-102, "Electrical Power, Disciplined" contains a complete discussion of the construction and operating theory of the constant voltage transformer, engineering and op-

erating data, and suggestions as to the practical use of these units as a built-in component of electronic and electrically operated instruments and equipment. Sola Electric Company.

CERAMIC CAPACITORS

32 A four page folder describing Hi-Q silver electrode ceramic capacitors—the CN type of capacitor with parallel leads. It contains detailed diagrams showing construction of capacitors together with photographs. Electrical Reactance Corporation.

AIR CONDITIONING

33 A 40 page catalog titled "Air Conditioning for Multi-Room Buildings." Advantages of air conditioning for hotels, hospitals, office and apartment buildings are told and the systems explained in photographs and charts. Carrier Corporation.

MAGNETIC DRIVE

34 A new 16 page booklet, No. 183, illustrates and describes the magnetic adjustable-speed drive for boiler draft fans, centrifugal pumps, centrifugal blowers and compressors, and other loads where torque required decreases with reduction of speed. Electric Machinery Mfg. Company.

WELDING

35 A new bulletin covering arc and flashwelding of simple ring and complex specialized frame types in the manufacture of a-c and d-c motors of both fractional and integral horsepower. It enumerates characteristics and economies obtainable. American Welding & Manufacturing Company.

CONNECTORS

36 A 12 page bulletin illustrating and describing plugs for radio and telephone circuits. Cannon Electric Development Company.

INSULATION MATERIAL

37 A 12 page booklet covering properties of Fiberglas electrical insulation materials and test data. Owens-Corning Fiberglas Corporation.

AUTOMATIC CLUTCH

38 Bulletin No. 4501 describes the new automatic clutch designed for operating loads up to 6 hp. Salsbury Motors, Inc.

ELECTRON TUBES

39 A new reference booklet giving typical operating conditions, characteristics and tube base diagrams for more than 450 types of electron tubes used in radio receiver and industrial electronic applications. Sylvania Electric Products, Inc.

WELDERS

40 An 8 page technical bulletin describing this line of flash welders. Phantom and detail views are used to illustrate the features, including the "unit" construction. Progressive Welder Company.

"We'll make money with *Paragon* INTERVAL TIMERS"

. . . because they're semi-automatic
. . . synchronous motor operated . . .
accurate in controlling the time intervals of hundreds of operations. For example, when preset they will turn on a fan . . . permit it to run for a predetermined time . . . then turn it off. The running time may be readily varied for each successive operation. Other applications are: plastic molding, batch mixing, heat treating, liquid agitation, light exposure, pump operation, watchman signals, food cooking, etc.

Paragon Interval Timers are rugged, durable, not affected by vibration or changes in temperature. Available in 8 different time ranges. The 2900 series (illustrated) is for wall mounting; 2400 series for flush panel mounting. Telechron Motored . . . completely self oiling and sealed against dirt. Reasonably priced . . . write for details on this and other Paragon time controls.

PARAGON ELECTRIC COMPANY
710 Old Colony Building
Chicago 5, • Illinois

"Mr. Tops," The Paragon Symbol of Top Quality

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT . . . SINCE 1905

RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods

RLM Threaded Dome Reflector

• QUAD Units have proved themselves in long-time service. Contractors enthusiastically endorse them because they live up to their claims — they give good lighting efficiency for long periods and require little attention. Install QUADS for industrial or commercial installation indoor or outdoor. Good business is the result. Quad . . . for today and for tomorrow.

Manufacturers of Incandescent Lighting Equipment

QUADRANGLE MFG. COMPANY

32 S. PEORIA ST.

CHICAGO 7 ILLINOIS

SWITCHES

41 Publication No. 4601 pictures and describes the improved MB-39 pole top and outdoor substation multi-pole capacities in ratings from 7.5 to 161 kv., and ampere capacities from 400 to 1200, either manual or motor operated. Delta-Star Electric Company.

INDUSTRIAL INSTRUMENTS

42 Catalog 370 illustrates and describes this line of recording and indicating instruments for measurement and control. The Foxboro Company.

MOTORS & GENERATORS

43 Catalog "FB" pictures and describes permanent-magnet a-c and d-c generators, split field d-c motors, permanent-magnet d-c motors, series and Universal motors, and shunt-wound d-c motors. Electric Indicator Company.

ELECTRONIC MARINE EQUIPMENT

44 Publication EBM-1 features new electronic communication and navigational aids for every class of ship in all types of maritime service. General Electric Company.

FLUORESCENT LIGHTING

45 A 120 page catalog entitled "Ceilings Unlimited" tells the story of fluorescent troffer lighting systems for offices, stores, schools, public buildings and factories. The Miller Company.

ELECTRODES

46 A 16 page booklet describing the physical and chemical properties of yellow-shielded phosphor bronze electric welding rods. It gives uses and techniques for welding copper, bronze, cast iron, steel and alloys. Eccles & Davies Machinery Co., Inc.

MAGNET WIRE

47 An 88 page catalog featuring the various types of magnet wire; inspection and spooling information, NEMA specifications, Vega-Chromoxide specifications, magnet wire tables and decimal equivalents. The Electric Auto-Lite Company.

INDUSTRIAL X-RAY

48 New 12 page booklet describing "Industrial X-ray" equipment covers many varieties. Specifications, application and benefits are outlined for each type. North American Philips Co., Inc.

HOME INTER-COMMUNICATION

49 Folder enumerates advantages of voice-to-voice contact between rooms and areas of modern homes. Price, installation method and operation is included in discussion. Executone Inc.

INDICATING INSTRUMENTS

50 "Electrical Indicating Instruments" is 32 page booklet discussing and picturing wide range of dials and instruments with mechanical features, ranges and applications listed. Also included is description of production techniques and research facilities. Marion Electrical Instrument Co.

RECEIVING TUBES

51 Essential characteristics and important ratings of receiving tubes, publication ETR-15, is a 40 page compilation for radio servicemen and technicians as well as electronic engineers. Four main divisions present technical data and its interpretation, recommendations for tube types, characteristics and ratings and outline drawings. General Electric Co.

MOTOR-GENERATORS

52 Bulletin 202 is clear, technical discussion of motor-generators specially designed for electroplating, anodizing, galvanizing, coloring, polishing and typing. Construction, application, advantages, characteristics and accessories are treated. Electric Products Co.

HOME ELECTRICAL USES

53 "Electrical Living" with scenes from Disney's "Dawn of Better Living" is 40 page multi-color book for consumers, contractors, builders and architects. Practical ideas on planning and equipping kitchens, laundries and other rooms outlined for various economic levels and size of homes. Westinghouse Electric Corp.

ENGINEERING REVIEW

54 Substation equipment, transformers and switchgear, are summarized in 1945 annual engineering review. Trailer-type units, assembly-line production methods, high voltage breakers, improved enclosing cases, controls and numerous other recent developments are explained in detail. Allis-Chalmers Mfg. Co.

ELECTRONIC PRODUCTS

55 Generously illustrated brochure on radio transmitting tubes and electronic equipment describes and illustrates complete line of vacuum tubes including triodes, tetrodes, rectifiers, vacuum capacitors, vacuum switches and diffusion pumps. Eitel-McCullough, Inc.

GAS ALARMS

56 Technical bulletin 1116-E describes method for detecting and giving audible notification of hazardous gas or vapor conditions often present in industrial processing. Principle, construction and operation is discussed with schematic diagram of typical installation. Davis Emergency Equipment Co., Inc.

HEATERS

57 Built-in wall unit heaters discussed and specified in AIA File 31-K-3 Bulletin 73. Construction and installation data included. Frank Adam Electric Co.

TACHOMETERS

58 Bulletin 1045 illustrates and describes nine different types of dial

and vibrating reed tachometers including portable and stationary types, single and multiple ranges, domestic and imported Swiss units. Herman H. Stitch Co., Inc.

COMMUTATORS

59 Commutator Catalog and Price List includes line drawings, specifications, dimensions and list price of repulsion induction refrigerator commutators, commercial and automotive commutators. Kirkwood Commutator Co.

ELECTRONICS

60 "The Business Man's Guide to Electronics" is 28 page booklet telling, in nontechnical terms, what electronics is accomplishing, the fundamental functions, application for induction heating, dielectric heating, welding, control and regulation, power conversion, protection, sorting, counting, weighing, inspection, measurement and analysis of present day products. Westinghouse Electric Corp.

WELDING BRUSHES

61 Carbon Brushes for d-c Arc Welders, Catalog 15, is a single-source reference book listing manufacturers welding equipment using the brushes, models, types, amps. and other pertinent data. Illustrations and dimensions included. Ohio Carbon Co.

PORTABLE GENERATORS

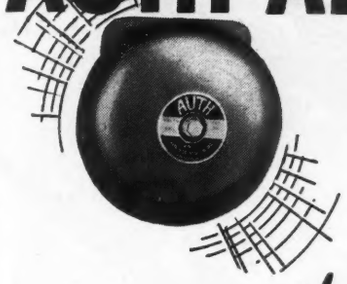
62 New line of portable gasoline-engine-driven generators is described in Bulletin L-406. Sizes range from 500 to 5000 watts, a-c or d-c, 6 to 230 volts, 50 to 800 cycles for units recommended for floodlights, P-A systems, power tools, radios or battery charging. Homelite Corp.

RELIGHTING SERVICE STATIONS

63 A "Scrapbook of Improvement Suggestions" is a new 52-page booklet for service stations, car dealers, garages and repair shops. Modernization and improvement stimulated with liberal pictorial and sketched illustrations for clear, factual text. Exteriors, interiors and shop treatments presented with accent on lighting. Benjamin Electric Mfg. Co.

Guiding the activities of the Electrical Maintenance Engineers of Milwaukee are its new officers: (L to R) secretary —E. C. Siller, Phoenix Hosiery; president—J. Spielmann, Wisconsin Electric Power Co.; treasurer—R. E. Lombard, Milwaukee Sewerage Commission.

AUTH ALARMS ARE RIGHT

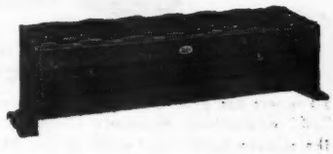


for those who want to know what's wrong!

FIRE ALARMS

Underwriters-approved, Auth fire alarms include general alarm systems; pre-signal alarms; common code, general alarm; pre-code, continuous alarm; city connected; and open circuit systems. Stations and gongs or chimes can be selected from the Auth line to suit any application. Bulletion No. 70.

BURGLAR & HOLDUP ALARMS



The proper combination of Auth gongs or sirens, foot-rail switches or any of the bank alarm buttons, and Auth control panels, gives your customer the protection he needs—with Auth dependability. Bulletin No. 55.

See Bulletin No. 60 for a wide selection of burglar alarm contacts. Consult Auth engineers for wiring and engineering information.

INDUSTRIAL ALARMS

There are many places in industry where Auth alarms can spot trouble before damage is done. Typical are boiler pressure, circulating water, oil pressure, motor temperature, and air pressure alarms. When pressure, temperature, liquid level, or similar switches find something wrong, a signal is immediately relayed to the Auth supervisory alarm panel with both visible and audible indication. Ask our engineers for suggestions and technical details to fit your requirements.

1-Y

AUTH ELECTRICAL SPECIALTY COMPANY, INC.
422 EAST 53rd STREET NEW YORK 22, N. Y.
Offices in AUTH Principal Cities
SINCE 1892

. . . CUSTOMER FOR
PROTECTIVE
LIGHTING INSTALLATION

. . . CUSTOMER FOR
ADVERTISING
LIGHTING INSTALLATION

. . . CUSTOMER FOR
GENERAL
LIGHTING INSTALLATION

FIGURE ON COMPLETE INSTALLATIONS BY INCLUDING

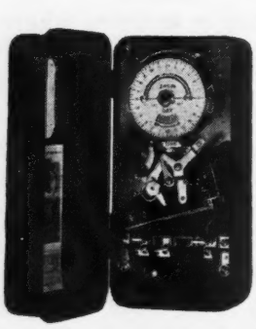
Sangamo TIME SWITCHES

FORM KAZ—SYNCHRONOUS MOTORS SILVER CONTACTS

Six levers are provided for a maximum of 3 daily "on" and "off" operations. Accurate timing is obtained by turning the minute hand reset staff on the 24 hour dial. If desired the time-switch can be manually operated without affecting subsequent operations. Available in a wide variety of combinations providing two-circuits, duplex, and outdoor switches; also with Sunday and holiday omitting device, as well as advance time cutoff. The KAZ Astronomic Dial Time-Switch functions to close the circuit at sunset and open it at sunrise, or the "off" operation may be set at any time between 9:30 P.M. and 2:15 A.M.

FORM VSWZ SYNCHRONOUS MOTOR WITH CARRYOVER

Synchronous timing is combined with reserve spring clock operation, providing continuous operation during current interruptions up to ten hours. This entirely automatic carry-over eliminates the necessity of resetting the dial after current interruptions, and insures accurate timing under all conditions. Equipped with Astronomic Dial.



ASTRONOMIC DIAL: Both of the Sangamo Time Switches shown here are equipped with Astronomic Dials. These dials enable "on" and "off" operations in accordance with sunset and sunrise.

• When you add SANGAMO TIME SWITCHES to the "General," "Advertising," or "Protective" lighting installation estimate, you are doing a service for your customers as well as including extra profit for yourself.

You will be providing AUTOMATIC CONTROL that is tops in performance and that is modern in every respect. Years of service by SANGAMO TIME SWITCHES in a wide variety of installations, and in all parts of the country, have proved their reliability.

Get the facts on SANGAMO TIME SWITCHES at the earliest possible moment. We will be glad to send you a catalog.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Answered by
F. N. M. SQUIRES and GLENN ROWELL
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

SAFETY SWITCHES FOR SERVICE SWITCHES

Q. *I have some 30 amp. safety switches on hand and find it impossible to secure 30 amp. service switches at the present time. Some of these are two wire for 125 or 250 volts and some are three wire 250 volt, evidently intended for three phase power work. Can I use these for service switches?*—A.K.

A. A 30 amp. service switch may be used where the load computed in accordance with the floor area requirements, does not exceed 30 amperes. Previous to June 30, 1942, when Interim Amendment No. 65 was approved, a 30 amp. service switch could not be used except by special permission on a two wire service supplying more than two 15 amp. branch circuits.

But now, the load is to be determined the same as for feeders and if that does not exceed 30 amperes a 30 amp. switch may be used, provided it meets other requirements for service use.

Safety switches in general are not provided with a bar for the connections of the neutrals while for service work a means must be provided in the service cabinet for disconnecting the grounded service conductor from the interior wiring. If the three pole switch is used on a two wire system, then of course, the third pole can be used for the neutral, but the fuse in that leg must be removed and a solid connection made in place of it.

Many utilities still require that no service switch of less than 60 amperes be used.—F.N.M.S.

FARM WIRING

Q. *When wiring farm buildings, I have often found it necessary to assure adequate clearance of overhead conductors supplying some of the lower buildings to mount a 4 by 4 or similar timber on the exterior building wall and extend it through the roof overhang. Recently I have received several rejection slips from the REA inspector saying that I must provide mechanical protection for the service entrance cable coming down this vertical timber where it pierces the roof overhang. I have always placed the service cable on the down slope side of this timber so I am unable to see any logic in this request. Does this happen to be a violation of the Code?*—A.S.

A. The only way in which the N. E. Code might cover your problem would be the requirement for protection of conductors against mechanical injury. The need for this protection is peculiar to that part of this country which has winter weather where alternate thaws and freezing weather is common. It was soon discovered that when this protection was not provided ice would form on the roof usually extending upward from the eave toward such an upright, and because of the ability of ice to expand when the weather turns warm we experienced numerous instances in which the insulation on these unprotected conductors would be crushed against this upright timber. Therefore it became common practice for inspectors to require this protection. Most contractors have placed a short piece of conduit on this timber and pulled their service cable through it. Others have had a conduit split lengthwise and have placed the half round section over the cable at the roof line. Either method seems adequate.—G.R.

TYPE R WIRE

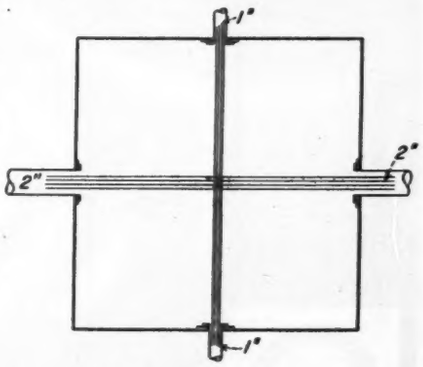
Q. *We have been told that type R wire can now carry the same amount of current as a type T wire and that we may use that column in table No. 1 of the Code now labeled for type SN wire. Is this true?*—M.R.

A. No. Present type R insulated wire cannot safely conduct the same amount of current that a type T insulated conductor may. The next edition of the Code will require a new type R insulation and conductors insulated with that will have similar carrying capacity with type T. However, this new insulation is not available now and probably will not be much before the 1946 edition of the Code becomes effective. Plans now call for this effective date to be November 1, 1946.—G.R.

PULL BOX OR JUNCTION BOX

Q. *The sketch below represents a pull box 16 in. by 16 in. Two-inch conduit entering and leaving at opposite ends with four No. 1 conductors passing through.*

One inch conduit containing four No. 8 conductors. The No. 8's tapped to the



No. 1's with pressure connectors. About 50 percent of the boxes have only one 1 in. conduit leaving the box.

The question—Is it a pull or junction box? Would Article 370—Section 3706, Par. 2 apply, or Section 3705 Par. a, apply?—H.G.

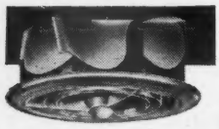
A. Apparently the box in question is primarily a junction or splice box on a feeder riser, used to tap off of the riser on each floor of a building. Of course it could be used on a horizontal feeder for the purpose of tapping off sub-feeds to panelboards.

In all probability the runs to the next similar box are not of sufficient length to require the use of a pull box as it is quite probable that the feeders can be pulled through several of these boxes

VETERANS' HOUSES

NEED CEILING VENTILATORS

Nearly two-and-three-quarter million veterans' families will want to keep their homes free from odors, grease and smoke.



Blo-Fan

CEILING VENTILATORS

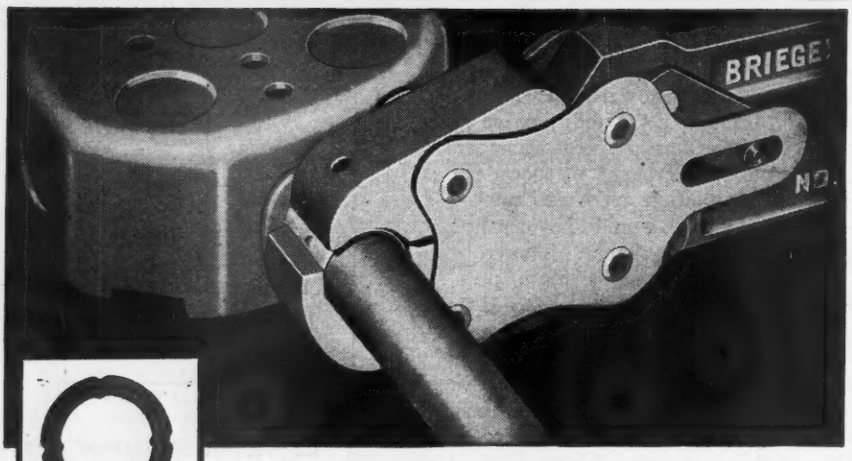
offer greater efficiency than any other type — combine the volume of a breeze fan with the power of a blower — are twice as effective as sidewall fans of equal size. Installed directly over the source of foul air, Blo-Fans capture smoke and odors as they rise — before they spread. Yet the installation cost is so little that owners of even modest homes can easily afford Blo-Fans — in kitchens, bathrooms, dens.

There is a Franchised "Blo-Fan" Wholesaler in your city.

PRYNE & CO., INC.

LOS ANGELES 54, CALIFORNIA

BRANCHES • NEW YORK • CHICAGO • HOUSTON • SAN FRANCISCO



Cross section Showing Indentations.

E·M·T·UP THE QUICK WAY

Two Squeezes and it's Set

TWO QUICK SQUEEZES give you Finer, Faster Conduit Connections. B-M Fittings do away with the twisting, turning and tightening of nuts and save you valuable time and materials. Then too, they are stronger, neater and much easier to work with in tight places. Start using B-M Fittings today. Have more satisfied customers—more profits from each job!

(All B-M Fittings carry the Underwriters Seal of Approval)

DISTRIBUTED BY

The M. B. Austin Co., Chicago, Ill.
Clayton Mark & Co., Evanston, Ill.
Clifton Conduit Co., Jersey Cy., N. J.
Gen. Electric Co., Bridgeport, Conn.
The Steelduct Co., Youngstown, Ohio
Enameled Metals, Pittsburgh, Penn.
National Enameling & Mfg. Co., Pittsburgh, Pa.
Triangle Conduit & Cable Co., New Brunswick, N. J.

BRIEGEL METHOD TOOL CO. • Galva, Ill.

without the necessity of "looping" at each box.

However, in applying the Code ruling to such an installation, it would be well to consider it as a pull box and to require that the distance between the walls where the 2-in. conduits enter and leave, be eight times the 2 inches (trade diamters of the conduits) and thus be 16-in. in accordance with 3706 a-1. As for the width of the box, it will be noted that the No. 8's in the 1-in. conduits are not pulled through the box but terminate, in it. Therefore 3706 a-1 would not necessarily apply although the 8-in. required for the 1-in. conduits should be provided for the ease of making the taps. If more room was needed for this, the first sentence of 3705 would apply, so that "sufficient free space" for all of the conductors would be available.—F.N.M.S.

LIGHTING FIXTURES

Q. *In a recent issue it was stated that one manufacturer had obtained an Underwriters' approval on a lighting fixture for use in a Class 1 Group A location. Could I get information on this fixture? In this plant we have Class 1 Group A locations.*—L.J.G.

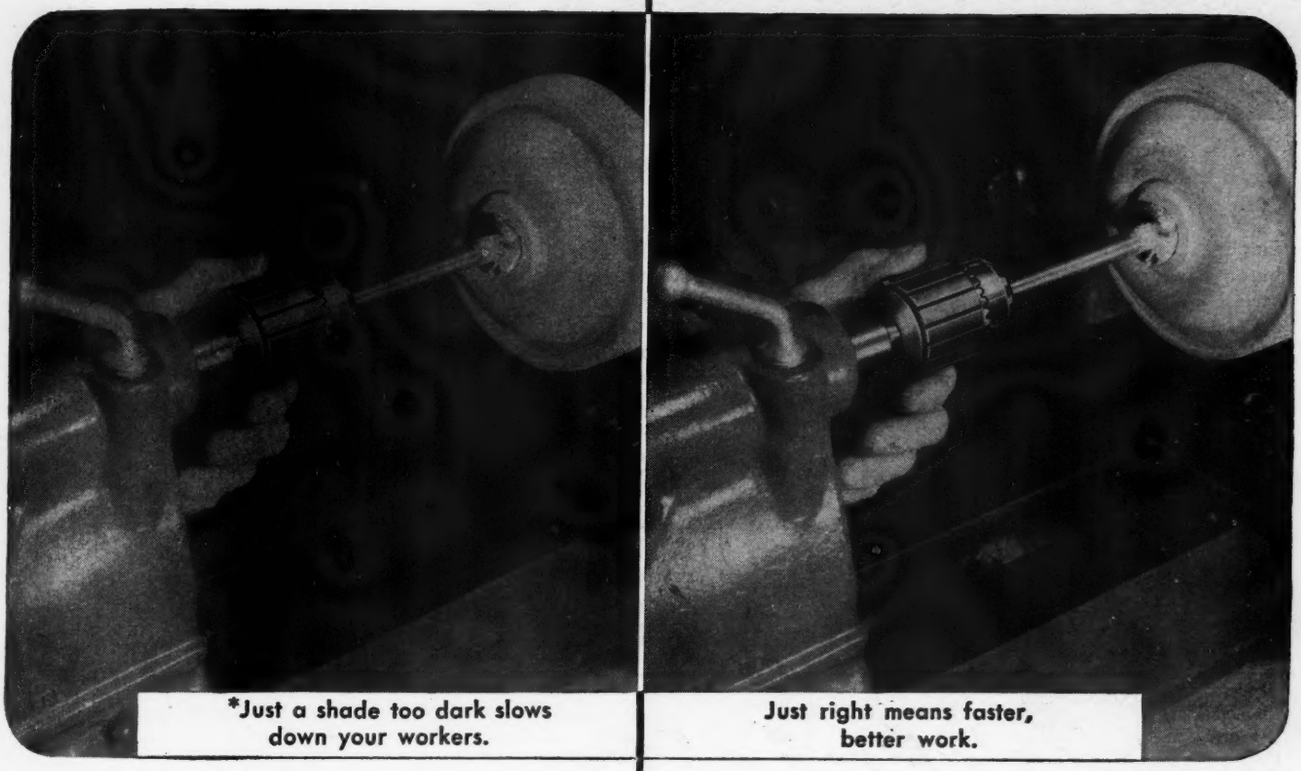
A. Lighting fixtures of an unusual type threaded for rigid conduit connection were first approved by the Underwriters' Laboratories, Incorporated, for use in Class 1 Group A and Class 1 Group B locations in June 1945. These fixtures are now manufactured by Safe Lighting, Incorporated, 401 Lafayette Street, New York 1, New York. They are made in both the 100 and 200 watt sizes. These fixtures are designed for operation with air pressure in the lamp compartment which prevents entrance of surrounding hazardous atmospheres and are so constructed that they must be removed from the hazardous atmosphere for relamping and/or the introduction of air under pressure of not more than 11 psi. Their operation is safeguarded by a bellows operated switch that disconnects the lamp from the circuit should the pressure within the lamp housing fall below a safe margin.—G.R.

SURGICAL LAMPS

Q. *We have the electrical contract on a new hospital building and have run into trouble with the surgical lamps being furnished for the operating rooms. It seems that they are not of the explosion-proof type so the local inspector refuses to permit their use,*

BORDERLINE VISION*

May be hampering production in your plant!



*Just a shade too dark slows down your workers.

Just right means faster, better work.

Eliminate lighting handicaps with Wheeler Skilled Lighting

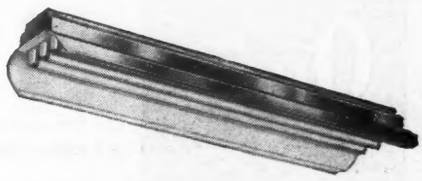
THE LIGHTING in your plant may *look* all right at a glance, yet be just a shade too dull or too bright in some places. Watch out!

That may mean that some workmen need two-looks-to-make-*sure* – and waste time. Or that they take chances on one look – *and rejects.* In either case production is hampered and costs go up!

Better work and reduced costs are practically automatic when you install evenly distributed shadow-free light, with efficient Wheeler Reflectors. Product of 64 years of specialized lighting experience, they are engineered to get maximum illumination *from standard lamps;* to stand up longer; to require less maintenance, for they are made of heavy-duty materials and high-grade vitreous enamel only.

Learn how Wheeler Reflectors and skilled lighting can bring you efficient lighting and cut your costs. Send for catalogs showing complete line of incandescent and fluorescent lighting fixtures. **Wheeler Reflector Company, 275 Congress Street, Boston 10, Mass.** Also New York, and principal cities.

Distributed Exclusively Through Electrical Wholesalers



All-Steel Open-End Fluorescent Unit
Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Mounts from chain or conduit, individually or in continuous runs.

RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Wheeler Reflectors

(SKILLED LIGHTING)

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

write SPEER for

Free Brush Information

...TRACK DOWN motor troubles!

Have motors or generators that are acting up—causing sparking, burning or overheating of brushes—excessive wear and energy losses? Let Speer help you find out why.

A common cause of these troubles is brushes improperly matched—mechanically or electrically—to machines. For nearly 50 years Speer has made a specialty of prescribing the right brush grades to deliver peak performance in *individual machines*—with fewest brush renewals and least maintenance in any set of operating conditions.

Having developed and tested thousands of different carbon, graphite, electro-graphite and metal-graphite grades, Speer can provide the *RIGHT* brush for any commutating equipment *you're* using or plan to build.

A letter will bring you Speer's Brush Data Forms *free*. Write for them today.

SPEER
CARBON COMPANY
ST. MARYS, PA.
841

CHICAGO • CLEVELAND • DETROIT
MILWAUKEE • NEW YORK • PITTSBURGH

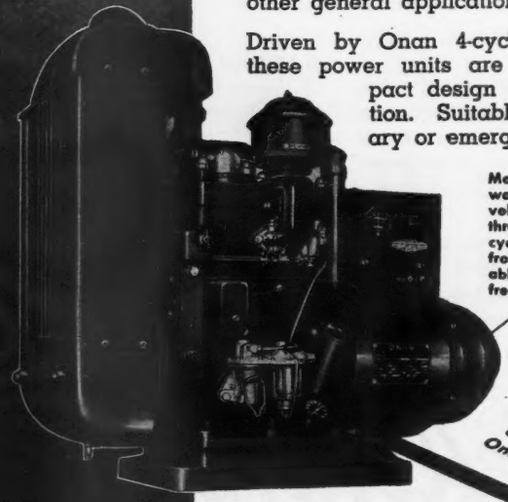
Electricity

ELECTRIC PLANTS
Onan

FOR ANY JOB—ANYWHERE

ONAN ELECTRIC GENERATING PLANTS supply reliable, economical electric service for industrial uses, as well as for scores of other general applications.

Driven by Onan 4-cycle gasoline engines, these power units are of single-unit, compact design and sturdy construction. Suitable for mobile, stationary or emergency service.



Models range from 350 to 35,000 watts, A. C. types from 115 to 660 volts, 50, 60, 180 cycles, single or three-phase and 400, 500 and 800 cycles, single phase. D. C. types from 6 to 4000 volts. Also available in dual voltage and special frequency types.

Write For Folder 690-A describing complete Onan Line

Model shown is from W2C series; 2000 to 3500 watts; powered by Onan two-cylinder, water-cooled engine

D. W. ONAN & SONS
2115 Royalston Ave. Minneapolis 5, Minn.

but the salesman claims that if they are permanently attached to the ceiling and are seven feet or more above the floor they need not be of the explosion-proof type. Who is right?—A.F.

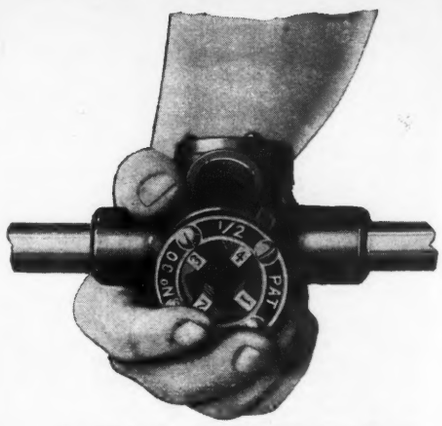
A. The National Electrical Code states that rooms in which highly flammable gases are manufactured, used, handled, or stored in other than their original containers shall be known as Class 1 locations. These various hazardous gases have different characteristics, so it was necessary to subdivide Class 1 locations into four groups and the Code defines a room in which anesthetic gases are used as a Class 1 Group C location. The present Code does not define the hazardous areas within a hospital but leaves that chore to the inspection authorities having jurisdiction. Realizing the need for further regulations governing the use of combustible anesthetic gases, the National Fire Protection Association appointed a committee to draft suitable standards and these standards were published in 1944. At the present time they are not part of the National Electrical Code. In these new standards permission is given to use ordinary or vaportight fixtures on the ceiling or if mounted seven feet or more above the floor provided the room or rooms are properly ventilated. The ventilation must be positive and amount to 20 cubic feet per minute per person in the room or rooms. Therefore these standards would permit the use of an ordinary surgical lamp within an operating room provided the lamp is so arranged that no part of it can be adjusted to a position within seven feet of the floor and provided a positive ventilating system is so arranged that it will remove at least 20 cubic feet of air per minute for each person in the room and cannot be shut off at the direction of some person during use of the room. In every case where such a ventilating system is not installed every electrical fixture or other device within the room or rooms in which combustible anesthetics are used must be of the explosion-proof Class 1 Group C type.—G.R.

FLEXIBLE CORD

Q. *Where in the Code is permission given to use a No. 20 gauge flexible cord?*—L.W.

A. Section 4006 of the N. E. Code has been revised by an interim amendment approved June 22, 1942 which gives permission to use a No. 20 gauge flexible cord for applications formerly permitted for type PO-64 cords as directed under note 2 on page 332 of the Code.—G.R.

GETS THE *OK* OF THE MAN ON THE JOB!



3-WAY THREADER

...Better All-Ways!

Compactly designed—the Toledo 3-Way Threader is lightest, smallest and easiest to operate of all 3-way tools! No. 30 threads ⅜" to ¾" pipe, wt. 4-¾ lb. No. 31 threads ½" to 1" pipe, wt. 7 lb. Efficient...dependable.

"TOLEDO"

Sure he's smiling—the *right* pipe tools mean satisfaction all around!

Contractors and mechanics today can count on "smooth going" from start to finish—with easy-threading TOLEDO Pipe Tools on the job. These accurate, dependable tools are engineered to do a better job and help you *cut costs!* Preferred by experienced hands for nearly half a century.

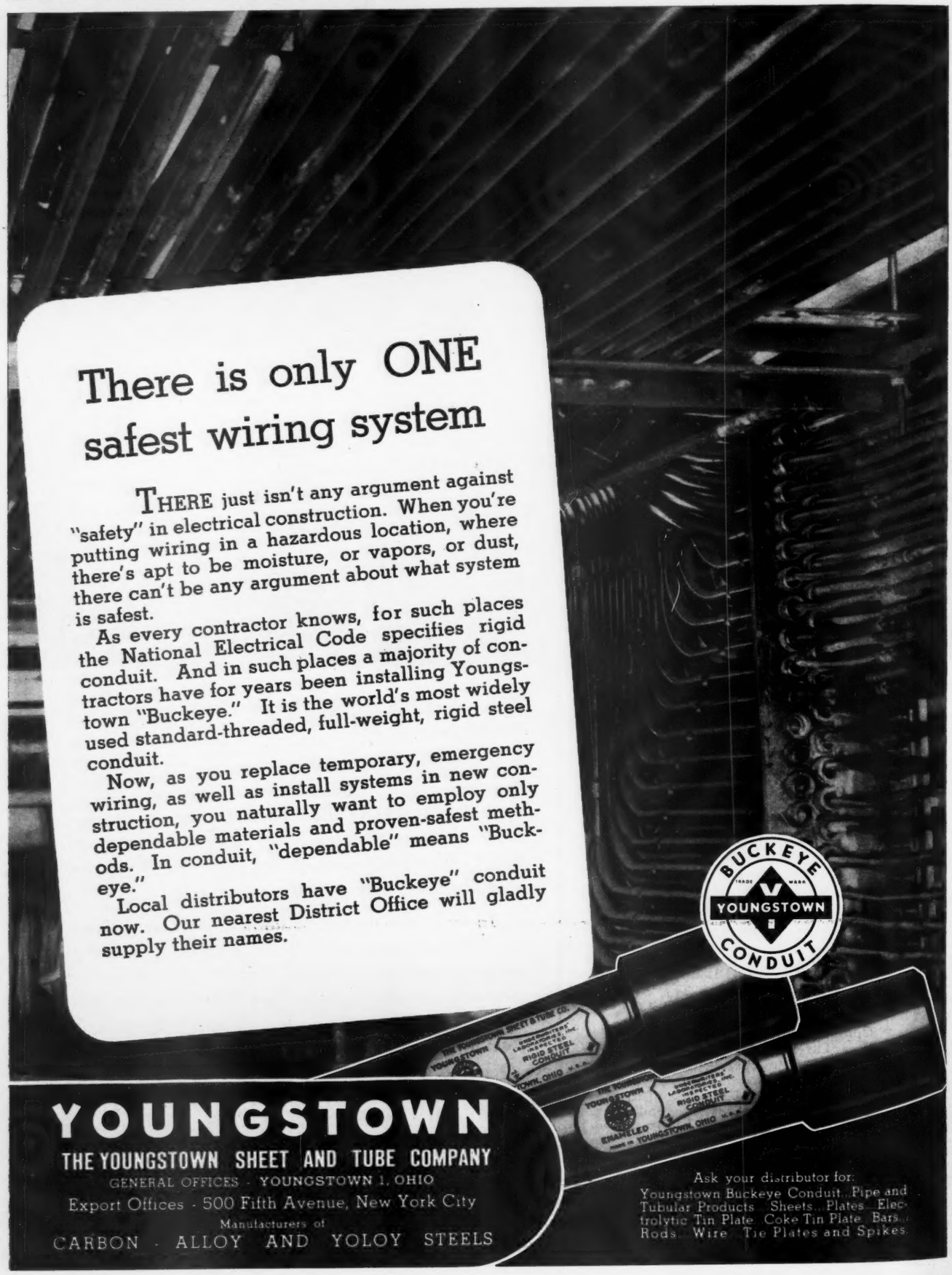
In these busy days of building in residential, commercial and industrial fields . . . gear your pipe fitting to greater efficiency. Specify TOLEDO for unbeatable performance! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

RELY ON THE LEADER...

TOLEDO

FOR PRECISION PIPE TOOLS

FOR SAFETY'S SAKE . . . USE CONDUIT (*Full Weight Rigid Steel*)



There is only ONE safest wiring system

THERE just isn't any argument against "safety" in electrical construction. When you're putting wiring in a hazardous location, where there's apt to be moisture, or vapors, or dust, there can't be any argument about what system is safest.

As every contractor knows, for such places the National Electrical Code specifies rigid conduit. And in such places a majority of contractors have for years been installing Youngstown "Buckeye." It is the world's most widely used standard-threaded, full-weight, rigid steel conduit.

Now, as you replace temporary, emergency wiring, as well as install systems in new construction, you naturally want to employ only dependable materials and proven-safest methods. In conduit, "dependable" means "Buckeye."

Local distributors have "Buckeye" conduit now. Our nearest District Office will gladly supply their names.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Ask your distributor for:
Youngstown Buckeye Conduit...Pipe and Tubular Products...Sheets...Plates...Electrolytic Tin Plate...Coke Tin Plate...Bars...Rods...Wire...Tie Plates and Spikes.

IN THE NEWS

LIGHTING EXPOSITION DRAWS RECORD ATTENDANCE

A new page has been added to the annals of America's lighting industry. For the first time in its history, leading manufacturers of lamps, lighting equipment and accessories have focused their attention on a single, mammoth exposition featuring the latest design and application developments in the commercial and industrial lighting fields.

Sponsored by the Industrial and Commercial Lighting Equipment Section, NEMA, the First International Lighting Exposition and Conference was held in Chicago's Stevens Hotel, April 25–30. Following a preview for registrants of the National Electrical Wholesalers Convention on the 25th, the exposition was opened to invited guests representing electrical wholesalers, contractors, utility personnel, architects, consulting engineers, industrial plant executives and engineers, public and school officials and other interested in lighting. During the five-day show, more than 10,000 visited the booths of some 83 exhibitors in the huge exposition hall.

S. B. Williams, past-president, IES, and editor of *Electrical World* keynoted the opening conference session with a challenge to "Relight America." At the exhibition, guests saw the manufacturer's product answer to this challenge; at the four conference sessions, they learned the technical and sales approaches to the vast lighting market ahead and the interdependence of the entire electrical industry in attaining its full development.

First of the four conference sessions was devoted to new lighting trends and methods. General in character, it embraced the market, quality of lighting and a forecast of future lighting research.

A lighting sales forum for electrical contractors embodied the second session. Recognizing the contractor as a key to lighting sales, installation and service, the forum discussions centered around programs designed to help the contractor develop these activities.

A third round-table session reviewed new methods and materials for technical and sales training. New market development plans, presented by representatives of manufacturer, utility, wholesaler, contractor and electric associations, reiterated the interdependence of these industry group in successful promotion of such activities.

Improvement of public relations and customer good will through a utility lighting program; effective use of manufacturers' lighting data sheets and specifications; demonstration of correct store lighting with a scale model; and a review of modern trends in lighting equipment, design and practice occupied the final conference session—a lighting service and application forum.

Considerable credit for the success of the exposition is due the nine-man industry committee chairmanned by E. C. Huerkamp, Westinghouse Electric Corp., Cleveland; and R. W. Staud, Benjamin Electric Mfg. Co., Des Plaines, who headed the program, publicity and attendance committees.

NECA TO AUGMENT IBEW PENSION FUND

Many electrical contractors employing members of the International Brotherhood of Electrical Workers, AFL, will have to pay an assessment equal to 1 percent of the gross electrical labor payroll each week if and when an agreement over pension fund payments becomes effective between the union and the National Electrical Contractors Association. While the agreement covers only members of NECA, the union has promised to impose its terms on nonmembers with whom it has contracts.

The agreement was in the process of development for more than a year, was considered by the NECA convention at Cleveland last October, and was ratified by the membership in December.

As submitted to the Wage Adjustment Board for approval, it provides for the creation of a "National Employees Benefit Board for the Electrical Contracting Industry" to establish and administer a fund for the purpose of augmenting the union's Pension Benefit Fund that has been in existence for 19 years. The national board will have 15 members (seven each appointed by the union and contractors and one by the Secretary of Labor) and will appoint local seven-man boards of similar structure to collect the 1 percent weekly from the contractors. The local boards will remit the collections monthly to the national board, which then will make payments quarterly to the union's pension fund. The union will make quarterly reports of receipts and disbursements from the fund.

While the contractors will contribute

"Of course, it does have plenty of outlets, dear."

Only QUIK-LABELS Have the Time-Saving *Self-Starter Strip

QUIK-LABELS' *Self-Starter Strip automatically exposes Label ends to peel instantly. Eliminates time-wasting, finger-picking trying to pry each Label loose. Every QUIK-LABEL Code Card has this exclusive feature. (*Pats. Pending)

ROUND OR FLAT SURFACES

QUIK-LABELS speedily, permanently identify Wires, Leads, Harnesses, Coils, Relays, Terminal Boards, Circuits, Cables, Pipes, Parts, etc. Pre-cut to exact size, stik-quik without moistening. • QUIK-LABELS' exclusive *Self-Starter Strip partly peels each Label to eliminate slow, aggravating finger-picking trying to pry Labels loose. Users' time studies prove QUIK-LABELS effect amazing savings in *buy-and-apply* costs over roll tape or other slow methods. • Only QUIK-LABELS are silicone plastic coated to resist dirt, grease, oil, fumes, weather and abrasion. • Maintenance men carry cards in pockets *right on the job.* Production operators insert cards in simple QUIK-LABEL Bench Dispensers (furnished at no charge) and code with *both hands free.*

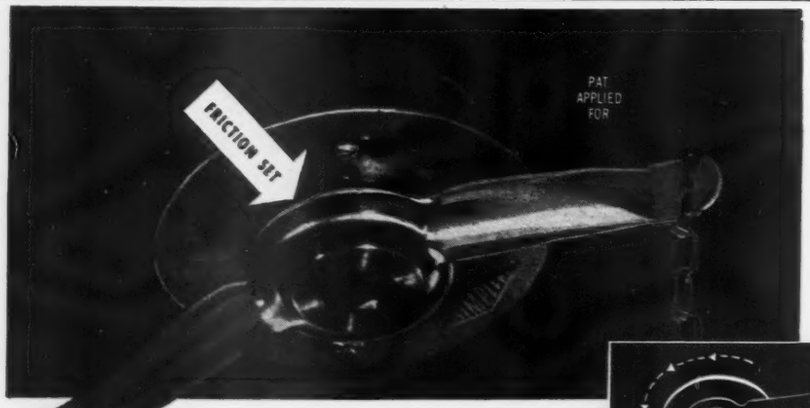
Write for Free Sample Code Cards and Folder

FREE SAMPLES

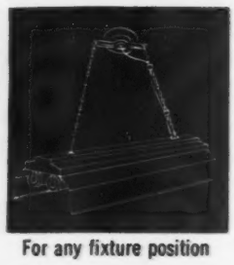
W. H. BRADY COMPANY

Identification Specialists

802 N. Third Street, Milwaukee 3, Wisconsin



360° Adjustment



For any fixture position

NEW "Friction-Set" FIXTURE HANGER . . .

That Adjust With a Twist of the Wrist!

At last you can get a Fixture Hanger that turns to any angle after being screwed to an outlet box. Although base and receptacle remain stationary, hanger arms may be turned to align with any preconceived lighting plan. Exclusive Friction Ring firmly holds fixture in selected position. Hanger screws on to 3¼" or 4" outlet boxes, no other fastening necessary. Furnished complete with receptacle, two 5' chains, hooks and cord clips.

Friction-Set K100 . . . List Price $1.10

SIMPLET ELECTRIC COMPANY

123 N. Sangamon Street • Chicago 7, Illinois

112 Charlton Street • New York 14, N.Y.

1 percent of the payroll to the jointly-adminsitered fund, the national board will turn into the union's pension fund only as much as is contributed by the union members themselves, which now is 57 cents a month per member.

On the basis of approximately 100,000 IBEW members employed in the industry, the cost will amount to $684,000 a year. The union claims to have contracts with approximately 7,000 electrical contractors, about half of them NECA members.

In submitting the plan for government approval, Paul M. Geary, NECA executive vice president, and E. J. Brown, IBEW president, stated that the cost of the contributions will not be made the basis for increasing the price of any contracts with the government.

The purpose of the agreement, NECA told *Electrical Contracting,* is merely to bolster the financial condition of the union's pension fund, from which union members may receive $42 a month at the age of 65 if they have been members in good standing for 20 years. Two dollars is paid back to the international union as per capita tax. The amount, or other basis, of the payments is not changed by the agreement.

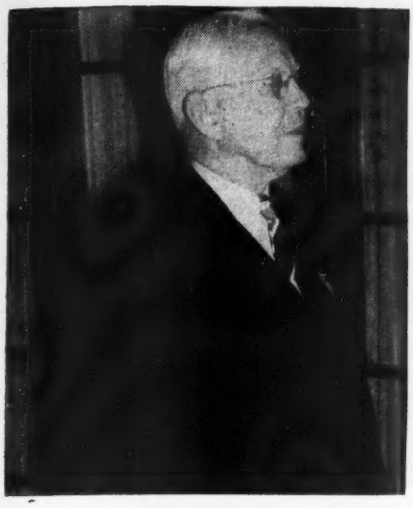
While the present agreement is limited to the pension payments, it opens the door to broader benefits in the future by a provision which instructs the joint national board:

"To secure and compile accurate statistics regarding the number, age, health and employment record of members of the Brotherhood employed by electrical contractors, and to make actuarial studies based on such statistics and prepare for the consideration of the industry plans for providing its employees with disability and hospitalization insurance as well as such other social benefits as are economically sound and will receive public acceptance."

WM. McGUINEAS RETIRES

With more than a half century of active participation in the electrical construction field behind him, Wm. McGuineas has decided to "call it a day" and retire to a well-earned extended vacation. The Dean of Chicago's Electrical Contracting Industry has voluntarily placed himself on the "inactive" list. Through this decision, the Electrical Contractors Association of City of Chicago loses a president who has held that office for 23 years (22 of them consecutive); a fighter in labor-management squabbles whose opinions have been highly respected, whose "bargaining" labor circles have always been considered fair.

During his career, McGuineas has had



Wm. McGuineas

his "ups and downs"—mostly "ups." Much of his time has been spent at executive chores. "Mac" started his electrical career as a stock boy with the old Thompson-Houston Electric Company of Chicago (later absorbed by the General Electric Company). In 1894 he became associated with the firm of Rattenbury and Jones and continued with Arthur Frantzen when he took over the R & J Company. When Frantzen decided to liquidate the firm in 1910, McGuineas and another employee organized the United Electric Construction Company—at present one of Chicago's leading electrical contracting firms. Succeeding McGuineas as president of this company is John R. Strohm, who has been associated with the firm for some years.

"Mac's" interest in the electrical industry was not confined to his own company. He was active in association work, being president of the Electrical Contractors Association of City of Chicago during the stormy labor rows of 1916–1917. When Lyle Grey died in 1924, McGuineas took over the president's chair and was re-elected for 22 consecutive terms. During that period he was also a member of the association executive committee.

COAST CONTRACTORS ELECT OFFICERS

Following the election of officers for the San Francisco Electrical Contractors Association, Inc., a chapter of NECA, late in January, the association a month later held its annual dinner honoring the past president, James M. Galvin, and presented him with a watch.

Elected president to succeed Galvin was Thomas Harris of H. S. Tittle Company. Other officers were Everett Carlson, Central Electric Co,, vice president; Edward W. Scott, Scott Electric Co.,

SORGEL
AIR-COOLED
TRANSFORMERS

for Contractors
and Industrial Applications

Priced according to a FAIR sales policy

Economical and Convenient to Install

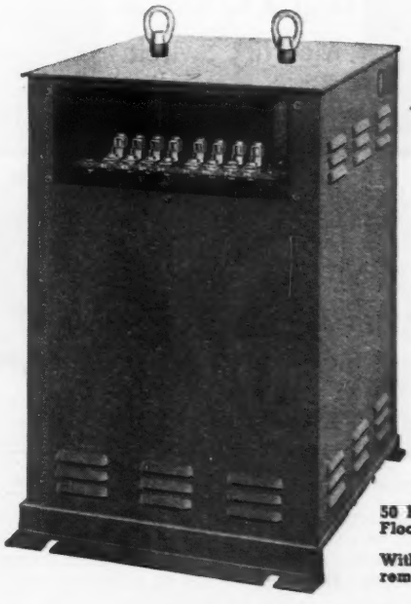
Mount on wall, post, or floor.
No extra brackets required.

Convenient connection compartment.
No extra junction boxes or fittings.

Enter primary or secondary on either side, or both on one side.

Connect to solderless terminals.

No Splicing, No Soldering, No Taping



50 KVA.
Floor Mounting Type.

With cover of connection compartment removed, showing solderless terminals.

Single phase units are interchangeable.

460 or 230 volt primary
230 or 115 volt
2 or 3 wire secondary.

A size and type for every purpose.

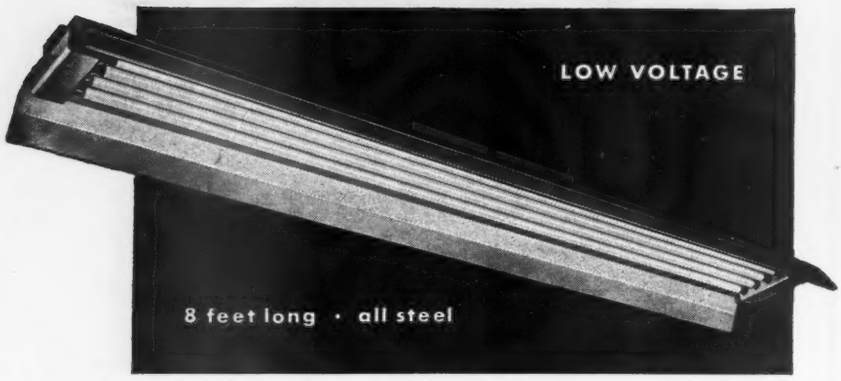
¼ KVA to 1000 KVA
All voltages.

Single phase and poly-phase.

SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Transformers

*COLOVOLT COLD CATHODE INDUSTRIAL FIXTURES



Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and *pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.*

*Trade mark registered U. S. Pat. Off.

Contact your electrical wholesaler or jobber, or write us for full details and prices.

GENERAL LUMINESCENT CORPORATION
672-S. FEDERAL STREET CHICAGO 5, ILLINOIS

MERCOID

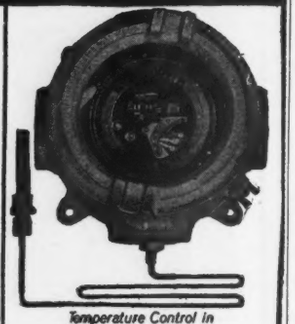
The Only 100% Mercury Switch Equipped Controls

FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

If you have a pressure or temperature control problem Mercoid engineers will assist you.

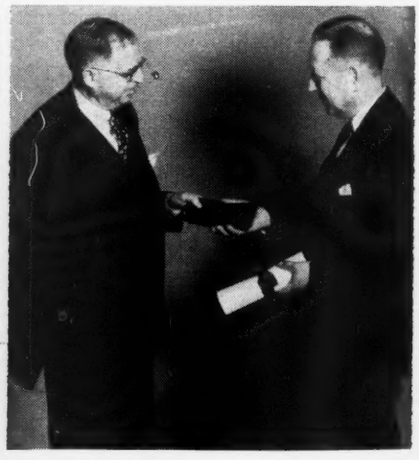
See catalog No. 600 for complete information on all types of Mercoid Controls.

THE MERCOID CORPORATION, 4225 BELMONT AVE., CHICAGO 41, ILLINOIS

secretary; George D. Smith, Smith Electric Co., treasurer; and, as directors, H. C. Reid, Carl C. Severin, George F. Brayer, Ed Conroy of Weber & Conroy; Pat J. Furlong, Century Electric Construction Co.; Grant Whitaker, of Manning & Whitaker, and past president James M. Galvin of Galvin Brothers. The meeting date each month was changed from the first to the fourth Thursday.

HERB METZ RECEIVES McGRAW AWARD

Herbert Metz, assistant manager of the metropolitan district of the Graybar Electric Company, has been awarded the 1945 Wholesalers Medal, given under the James H. McGraw Award. The presentation was made on April 23 by S. B. Williams, secretary of the Committee of Awards, at the spring meeting of the National Electrical Wholesalers Association, Stevens Hotel, Chicago. The citation accompanying the Award read as follows:



Herb Metz receiving McGraw Award from S. B. Williams

"In the market place as well as on the field of battle men are singled out for special honors because they have unselfishly given of themselves beyond the line of duty that others might be benefited. Today we honor Herbert Metz who, as chairman of the Post War Planning Committee of the National Electrical Wholesalers Association, generously gave of his time and energy to the creation and fulfillment of a program which has been acclaimed by the members of his industry for its stimulus to sound thinking and planning not only by electrical wholesalers but by their suppliers as well.

"The record will show also that Mr. Metz, now assistant manager of the Metropolitan District of the Graybar Electric Company, has been a tireless contributor to electrical industry efforts. All the while he was directing the wholesalers' Post War Planning Committee, he was also chairman of the Adequate Wiring Bureau, an activity which, as a result of the leadership it enjoyed, has emerged from the difficult war years stronger in interest and support than ever before.

"Instead of attempting to duplicate the work of other postwar planning organizations, Mr. Metz, by personally arranging an unusual series of forums on a variety of topics affecting the electrical wholesaling business, was able to bring to bear on the electrical wholesalers' postwar problems the consideration of outstanding authorities in several fields. The data and views thus developed have assisted electrical wholesalers greatly in their creative thinking and planning both for business and for employment.

"Sensing the growing need of electrical wholesalers for employees equipped to handle the increasing volume of electronic and other electrical adaptations not long out of the research laboratory, Mr. Metz and his committee conceived a program for the employment of technically trained returning service men. At the same time the appliance market was giving evidence of postwar volume beyond all previous concept, to plan for which wisely required a forecast based on sound economic analysis. To fill this need the committee gave to the appliance distributors for the first time a basis for considering potential electrical sales that excludes conjecture and guess work.

"For these contributions to his branch of the electrical industry, on recommendation of the panel of judges, the Committee of Awards has voted to Mr. Metz the 1945 Electrical Wholesalers Medal and Purse given under the James H. McGraw Award."

Honorable mention was given posthumously to Willard Hall, formerly vice president of Times Appliance Company, New York, in "recognition of his constructive contribution to postwar sales planning of electrical wholesalers through the origination, under the sponsorship of the Postwar Planning Committee of the National Electrical Wholesalers Association, of a basis for considering potential appliance sales that excludes conjecture and guess work, and can be a guidepost for success or failure in any appliance distribution."

The judges who selected Mr. Metz and Mr. Hall for these honors were John M. Newton, Oakes Electrical Supply Company, Holyoke, Mass.; E. B. Ingraham, Times Appliance Company, New York City; Warren I. Bickford, Westinghouse Electric Supply Company, Pittsburgh; Harry E. Perl, State Electric Supply, Oakland, Calif.; and S. B. Williams, editor of *Electrical World* for the Committee of Awards.

NEW NECA CHAPTER IN SACRAMENTO

Sacramento now has a chapter of NECA. The Electrical Contractors and Dealers Association, Inc., voted to become a chapter of NECA and was accorded the territory of the Sacramento Valley by the Northern California Chapter of NECA. J. Cotter, Reliable Electric Co., was elected president; J. D. O'Conner, Lupen & Hawley, vice president and also the governor for the chapter; J. W. Thomas, secretary; F. R.

KLEINS *the finest in pliers*

Since the first wires were strung—bringing the marvels of electric light and power to America—the electrical industry has advanced far. Yet, it is significant that the electrician today still uses the same pliers his grandfather used back when the industry was in its infancy—Kleins.

Klein Pliers were originally made because this industry needed tools better than any then available. Klein Pliers are still standard in the electrical field, because through the years they have kept pace with electrical progress, because they are still recognized by men who know good tools as the finest pliers available.

Kleins today are made in a wide range of sizes and types to fit every electrical need. Because the demand is so great, your supplier may not be able to fill your order immediately, but keep on asking—remember Kleins are worth waiting for.

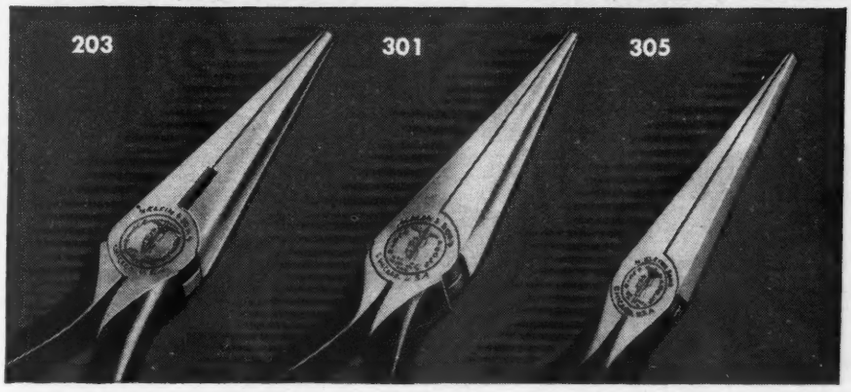
The Klein Pocket Tool Guide showing the Klein line and containing useful tables and information will be sent without charge.

ASK YOUR SUPPLIER

Since 1857

Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS



Here's a New READY REFERENCE BOOK on Commutators

Do you know we manufacture from 15 basic types over 3000 variations of Commutators? This data book contains all the specifications necessary for you to order your repairs easily. Some of these may even be in our stock.

We want you to have a copy of this book—write today. Which will it be—Toledo or Homer?

Three sources to choose from—all under capable and experienced management . . . Our representatives are located in key cities throughout the nation

TOLEDO STANDARD COMMUTATOR CO. – Toledo 6, Ohio
HOMER COMMUTATOR CORP. – Cleveland 3, Ohio
HILLSDALE COMMUTATOR CO. – Hillsdale, Michigan
NATION'S LARGEST EXCLUSIVE MANUFACTURERS OF QUALITY COMMUTATORS

COOPERATION

Everything to Build a Bigger Chime Business for you with

Mell-o-Chimes

★ ATTRACTIVE NEW DESIGNS!
★ POINT OF SALE DISPLAYS!
★ NATIONAL ADVERTISING!
★ DEALER AIDS!
★ COMPLETE LINE!

Visit Space No. 327
The Housewares Show
Atlantic City, May 12-17

Nation-wide Distribution thru Leading Wholesalers

AMERICA'S FINEST ELECTRIC DOOR CHIMES

National Sales Representatives: Hatheway & Co., 75 Montgomery St., Jersey City, N. J.
MELL-O-CHIME AND SIGNAL CORP.
119 SOUTH JEFFERSON ST. • CHICAGO 6, ILLINOIS

Merwin of Merwin & Gatejen, treasurer; and as directors, George C. Foss, C. S. Donley, Sterling Electric Co., and Ed H. Wilmunder. William Welch is business manager.

INDUSTRY SIGHTS SET FOR POSTWAR MARKET

More motors, lamps, ballasts, appliances, more of everything electrical and more emphasis on selling the awaiting market was the composite electrical industry picture presented at the recent Twelfth Annual Sales Conference of the Edison Electric Institute in Chicago. Registrants were given an insight into the production and sales plans of some of the industry's leading manufacturers.

Barring future obstacles such as additional labor difficulties or material shortages, this is what industry executives have predicted for the succeeding years:

General Electric Company plans, according to vice-president Robert S. Peare, for a 1946 production of twice as many fractional horsepower motors as in 1940; 2½ times as many ballasts. For 1947 these figures will jump to three times and 5½ times respectively. Lamp production has been substantially increased since 1940 and indefinite operation at full capacity is expected. Switchgear output will be 85 percent of the 1940 level for the balance of this year with a level of 205 percent being reached next year. The 1946 output of meters and instruments will substantially exceed the 1940 level and next year will be almost 100 percent greater.

Production of G.E. air conditioning and commercial refrigeration equipment during the balance of 1946 will be far below requirements, Peare revealed, but within the next 12 months his company expects to channel into the market a volume exceeding that of any pre-war years.

With respect to the market for electric motors, Westinghouse predicts a 1946 motor business throughout the country almost double that of ten years ago. According to a report prepared by G. A. Price, president, Westinghouse Electric Corp., his company is expanding medium horsepower motor production by 50 percent to meet the backlog of orders—this despite the fact that, under wartime pressure, they were able to produce about 200,000 horsepower per month of motors ranging from one to 200 horsepower in size.

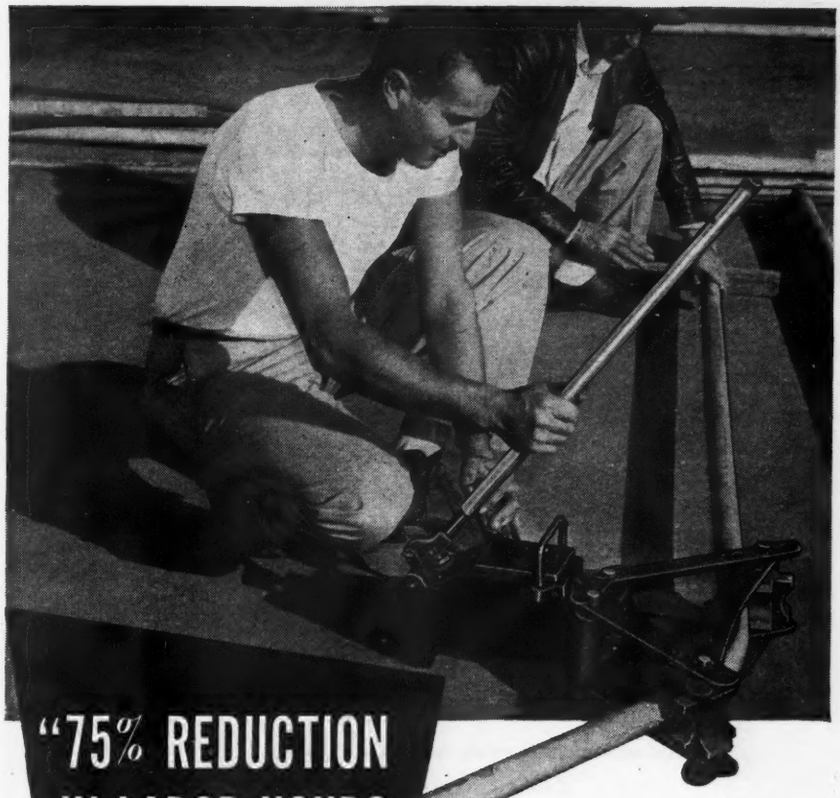
Warning against complacency, the Westinghouse executive, cited such future electric power markets as air cleaning, infra-red heating, high frequency heating, electric welding and others. The industrial and commercial lighting field has not been fully devel-

oped, he declared, adding that there are at least 100,000 factories and probably a million stores and other business establishments throughout the country where adequate lighting is needed.

Commercial cooking markets when fully developed will offer an estimated annual revenue in excess of 90 million dollars, declared Wm. A. Conley, Jr., sales manager, counter equipment, Edison General Electric Appliance Co. Due to a poor job of selling counter or back-of-bar appliances, the surface of this national market has yet to be scratched, he added. Conley urged the utilities and dealers to give more attention to the small lunch counters and restaurants that comprise 95 percent of this vast potential market and will account for 77 percent of the estimated revenue. This, incidentally, is also a field in which the electrical contractor can do a selling job, since any addition of electric cooking equipment—whether it be a toaster, hot plate or other item—will require additional wiring capacity.

Accent lighting (wall and counter cases, island displays, niche or cove, architectural lighting) provides a good market in the commercial lighting field, stated H. B. Gould, Ohio Edison Company. Based on a survey of 35,000 meters, his company discovered that accent lighting comprised an average of 10 percent of interior illumination—ranging from two percent in hardware stores to 43 percent in jewelry stores.

A vast market for rewiring commercial buildings awaits the industry, S. J. Rosch, manager, insulation products division, Anaconda Wire & Cable Company, told the conference. Asserting that every commercial building more than three years old is in need of electrical modernization, he outlined the 1946 National Electrical Code recognition of new cable insulation. These will be confined to two types—new Type R and T (60°C.) and Type RH (75°C.) with current capacities the same for all insulations in sizes No. 12 through No. 10 (because of voltage drop on branch circuits). Revealing that these new types of conductors would be on the market as of April 1, Rosch presented several tables of conductor and conduit combinations for various ampere loads to illustrate the economic advantages of the new conductor insulations. Based on the current rating of the new conductors, he predicts universal use of the 60°C. wire (new Type R and T) up to No. 6 and the application of the 75°C. (Type RH) for No. 6 and larger because of its higher current rating. Commenting on the chemistry of synthetic insulations, Rosch stated that coal and oil are becoming more valuable to the chemical industry than they are as a fuel. Hence, at some future date they may cease to be fuel sources.



"75% REDUCTION IN LABOR HOURS ...with GREENLEE Bender"

That's what California Electric Works, San Diego, California, reports from its experience in using six GREENLEE Hydraulic Pipe Benders on its many contracts.

"In addition," says Mr. T. R. Wright, General Manager of the Company, "we reduce material spoilage 50%." Proof again of the *tremendous labor and materials savings* made through use of the GREENLEE bending method . . . in place of the old ways of pipe forming and use of many fittings and manufactured bends.

On your jobs, too, you can make manpower go much farther *and have a more efficient installation* by using a GREENLEE. It's one-man-operated, compact, portable, easy to set up and operate. In a few minutes produces smooth, *precise* bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars.

Whatever your bending job, there's a GREENLEE to do it. Get complete facts now on GREENLEE Hydraulic and Hand Benders and other timesaving tools. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1745 Columbia Avenue, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

Insist on
"ADVANCE" BALLASTS
on all lighting equipment
YOU buy

"ADVANCE" BALLASTS EXCEL IN QUIET OPERATION, high efficiency performance, low replacement cost and long life. They permit easy installation in fixtures where only a limited space is allowed for ballasts. Designed by expert lighting engineers and approved by Underwriters Laboratories, "Advance" ballasts are the answer to all fluorescent lighting problems. LARGE MANUFACTURERS OF LIGHTING FIXTURES STANDARDIZE ON "ADVANCE" BALLASTS—so insist on this quality ballasts on the equipment YOU buy.

Cable Address "ADTRANS"

ADVANCE TRANSFORMER CO.

1124 W. CATALPA AVE. CHICAGO 40, ILL.

LUMINITE
REG. U. S. PAT. OFF.

Automatic Switch Light!

FOR BOTH SINGLE AND MULTI-GANG SWITCHES

LISTED BY UNDERWRITERS LABORATORIES, INC.

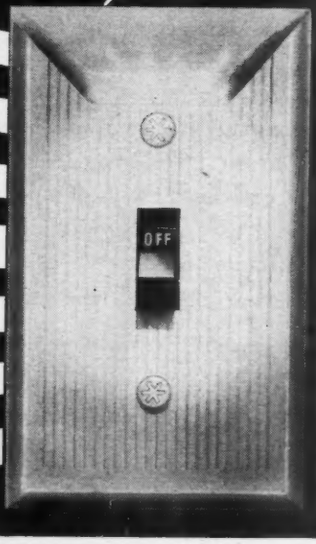
NATIONALLY ADVERTISED IN LEADING MAGAZINES

WIRING TERMINALS FOR EASY INSTALLATION

UNCONDITIONAL RENEWAL GUARANTEE

BEAUTIFULLY STREAMLINED IN GENUINE PLASKON

LITERATURE AND DISPLAY HELPS



The tiny shielded electric light is *always on* when the room is dark — *always off* when the room lights are on. Ends fumbling for switches. No more smudged walls. Single-gang, two-gang, and multi-gang assemblies available. Operates for less than 2c per year. Works also on 3- and 4-way switches. Guaranteed. For steady profits, sell the *original* LumiNite. List price $1.00. Write for details.

ASSOCIATED PROJECTS CO., 80 E. Long St., Columbus 15, Ohio

To those who viewed Rosch's prediction with trepidation, M. M. Smith, vice-president, Muncie Gear Works, Muncie, Indiana, had an answer—at least for residential heating. It is the "heat pump"—a heating system that uses no fuel; works on a reverse refrigeration principle, taking heat out of the earth (uses a well and closed water circulation system as a heat exchanger) to heat the home. Smith sees the potential power market for reverse cycle heating so large that it seems almost fantastic; sees the market to be mostly in new homes insulated to take full advantage of the unit's characteristics.

Discussing the load building aspects of the frozen food industry, George W. Meek, president, Frozen Food Foundation, Inc., predicted a connected load of from 2½ to 4 million horsepower at the end of 1950 with rural areas using a large chunk of power for locker plants, food freezing and home freezers.

Two to four million families are ready now to buy water heaters—most of them preferring electric units, stated W. F. Ogden, commercial engineer, Edison General Electric Appliance Company. Other markets open for electrical applications include refrigeration for industrial processes; infra-red heating and drying (one experimental application to the textile field uses 10,000 kw. of infra-red lamps in one plant); high frequency induction and dielectric heating; electrostatic painting, and numerous others. These were outlined by Robert C. Ely, Public Service Electric and Gas Company, Newark, N. J.

The nation's educational facilities embracing one million classrooms and laboratories (approx. 750,000,000 sq. ft. of floor space) with 29,650,000 students and 875,000 teachers, presents one of the biggest fields for good lighting, asserted Russell C. Putnam, associate professor, Case School of Applied Science, Cleveland. The average schoolroom—with a national average of 7 footcandles, with bare lamps and other glaring light sources all too common—lags far behind our knowledge and ability to provide the quantity and quality of lighting needed, he added. Professor Putnam, who is also consultant to the Engineering Department at Nela Park, strongly urged that a course in lighting be included in college and university electrical engineering curricula; that the fundamentals and application of lighting be taught to architectural students (Illuminating Engineering has been a requisite of the Electrical Engineering course at Case for 42 years). Putnam asked the utilities and manufacturers to cooperate in the teaching of the principles of good lighting by developing a program of demonstrations, slides, pictures and other visual aids.

Tips on the application of light for

selling were given by R. J. Chapin, superintendent of construction and maintenance, Marshal Field & Co., Chicago. Chapin, who is responsible for most of the general and display lighting features at the Field store in Chicago, outlined some of the problems encountered in getting the customers' attention.

Speaking at the final meeting of the conference, Frank W. Cortright, executive vice-president, National Home Builders Association, urged the electrical industry to produce devices that are "affordable" or within reach of the common man. Acknowledging that nothing sells a house more readily than those features appealing to the housewife, he suggested the following: formation of a joint committee of EEI and NHBA to keep each other informed on industry development; inclusion of heavy appliances (refrigerators, ranges, water heaters, etc.) in the mortgage loans; special presentations of the Adequate Wiring story in each community.

POWER CONFERENCE VIEWS ENGINEER RESPONSIBILITY

Engineers must shoulder an increased responsibility to society in a world of expanded technology. That was the thought that permeated practically every session of the 19th Annual Midwest Power Conference held at Chicago's Hotel Stevens, April 3-5, 1946. Sponsored by the Illinois Institute of Technology in cooperation with nine midwestern universities and eight technical societies, the three-day conclave gave an estimated 2500 registrants an opportunity to hear more than 70 speakers and chairmen who participated in approximately 20 sessions, luncheons and dinner programs. Conference subjects ranged from an appraisal of atomic energy as a power source to the latest technical developments and problems encountered in the generation, distribution and consumption of power.

Commenting in general following his detailed review of atomic energy, P. W. Swain, editor, *Power,* predicted possible use of atomic energy in central stations of 100,000 kw. and up and their Btu. equivalent in central heating and process plants; for long voyage ship propulsion and warships. The minimum of 50 tons of shielding required against radioactivity eliminates use of atomic energy for automobiles and small airplanes and makes it doubtful for locomotives, he continued. Swain doubts that any dependable technical defense against atomic weapons will be developed and believes that in a few years all large nations will know how to manufacture them.

These are "Musts" in Fluorescent Lighting

FLEX-LOC Lamp Holder

FLEXIBLE: Automatically self-adjusting to variations in length of lamps and spacing of mounting holes. Engineered to fit all standard spacings.
AUTOMATIC LOCK is positive. No extra locking devices are needed. Lamp cannot fall out.
EASY INSERTION AND REMOVAL of lamp. No twisting. No turning.
PERFECT ELECTRICAL CONTACT: Brass contacts grip BOTH sides of lamp pins securely.

Listed and Approved by
UNDERWRITERS' LABORATORIES INC.
E.T.L. Test Report No. 314454 Is Available

This Starter
AUTOMATICALLY
Cuts Out

- " " deactivated or flickering lamps.
- " " current to lamp and ballast.
- " " high maintenance costs.
- " " high power consumption.
- " " short lamp and ballast life.

AUTOMATICALLY
Resets

- **when new lamp is inserted.**
- **without fussing with starter.**

PLASTIC CAN has greater dielectric strength. The boldly knurled rim makes insertion and removal easier, and there are no projecting lugs to cause trouble. The can is SEALED.

Listed and Approved by
UNDERWRITERS' LABORATORIES, INC.
Certified by Electrical Testing Lab., Spec. 6

LLOYD PRODUCTS LEAD

BECAUSE Lloyd has set up engineering specifications more rigid than the accepted standards.

BECAUSE only the best materials are used in their construction.

LLOYD POLICY INSURES QUALITY

LLOYD PRODUCTS CO.
79 Gordon Ave. Providence 5, R. I.
Branch Offices and Warehouses in 27 Leading Cities

PARTS FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCK

AUTHORIZED PARTS DISTRIBUTOR

Brown-Brockmeyer	General Electric	Master
Century	Hamilton-Beach	Peerless
Cutler-Hammer	Holtzer-Cabot	Robbins & Myers
Delco	Howell	Star
Diehl	Hunter	Thor
Duro	Ilg	Wagner
Emerson	Leland	Westinghouse
	Marathon	

READING ELECTRIC COMPANY, INC.

Parts Distributors for the Manufacturer

200 William St. Barclay 7-6616 New York 8, N. Y.

RELIANCE AUTOMATIC TIME SWITCHES

Model "W"

Completely automatic . . . extremely simple, compact, economical . . . three types cover practically every requirement . . .

ASTRONOMIC TIME SWITCH

• The Model "W" Astronomic types are particularly popular for advertising illumination. The "on" operation changes daily to correspond with local sunset time, eliminating the necessity of re-setting the dial as the days become longer or shorter.

AMERICA'S RELIABLE 24 hour-a-day GUARDIANS

RELIANCE Time Switches have proved their dependability. They give complete and reliable service under many varied conditions—a factor of paramount importance when constant good service is essential. Send for catalog and price sheets for complete details.

RELIANCE AUTOMATIC LIGHTING CO.

1907 MEAD STREET RACINE, WISCONSIN

This situation, he added, calls for drastic moves in the national and international fields to head off atomic wars. Meanwhile, Swain would immediately free nuclear research to obtain the tremendous benefits—particularly in biology and medicine expected from these studies by using "tagged" atoms as tracers.

"Interchange of information on technical developments and a working partnership in research (beween civilian and military engineers) are essentials to the engineering foundations of national security," asserted Rear Admiral H. G. Taylor, Naval Superintendent of Civil Engineering, Chicago.

Addressing the same dinner session, Lieutenant General Raymond A. Wheeler, Chief of Engineers, U. S. Army, Washington, D. C., outlined the activities of the Corps of Engineers in war and peace. He praised the industry for its contribution to the war effort.

That a civilization cannot be built around the test tube and laboratory was emphasized at a general session entitled "Your Nation's Future—an Engineering Problem." How an engineer can become an effective force in community and public life was discussed by six prominent engineers and educators.

D. C. Prince, vice-president, General Electric Company, told a luncheon session that the reconversion program must be completed and added effort made to swell the output of goods and services, if a repetition of the 1919-1930 "boom and bust" era is to be avoided.

A paper prepared by T. N. Adlam, Sarco Co., Inc., New York, reviewed the application of radiant heating to commercial and residential occupancies. Among the development of "panel heating" to overcome cold spots left by the general heating system, were portable screens made from tapestry in which the electrical heating conductor was woven in the fabric; also similar tapestries for wall mounting.,

A joint report by Philip Sporn, E. R. Ambrose and Theodore Baumeister, American Gas & Electric Service Corp., New York, revealed that the heat pump (a reverse refrigeration cycle requiring no fuel) provides an economical industrial heat source. It has an ideal cycle efficiency of 11.2 percent and an actual coefficient of utilization ranging from 4.6 to 6.7. With an assumed coefficient of utilization of 6, such pumps can produce heat at 4.8 cents per one million Btu. compared with 29 cents for the same amount of heat produced by a conventional radiant heating unit using energy at a cost of one cent per kwh, according to the report.

The inherently designed high amplification factor, high speed of response, and reliability have enabled rotating regulators to compete successfully in fields formerly thought to be exclusively

electronic, asserted L. T. Rader, Illinois Institute of Technology, while reviewing the characteristics and application of these recently developed devices. Rader covered the Amplidyne, Rototrol and Regulex Exciter, listing such applications as acceleration control, speed control, variable speed control, constant horsepower control and current control.

Reviewing the recent application of silicones to insulation problems, G. L. Moses, Westinghouse Electric Corp., East Pittsburgh, predicted great improvement in thermal stability of insulation for electrical machines.

Regarding the promising future of electric cable insulations, R. J. Wiseman, chief engineer, The Okonite Company, Passaic, N. J., predicted a return to natural rubber for cables used in wet locations and high voltages; use of synthetic rubber where it has an advantage as a covering; use of thermoplastics for house wiring and where light-wall insulation is desired; use of neoprene type coverings to get away from the short life braid coverings; application of high-temperature Silastic (Silicone rubber) for connections to high wattage fixtures or motor leads in extremely hot locations.

TULSA CONTRACTOR REORGANIZES FIRM

Reorganization of the Circle L Electric Company, Tulsa, Oklahoma, took place March 1. Under the new company set-up, former owner Wm. R. Henson—in the contracting field for 29 years—becomes president; L. A. West, associated with the electrical contracting field for 31 years, becomes vice-president. Allen D. West, a graduate engineer, will handle the engineering for the firm.

Future plans of the new organization embrace specialization in industrial, commercial and residential lighting sales and installation as well as electrical construction work in these fields. The headquarters of the firm are to be enlarged to accommodate engineering and office space, show room and stock room facilities.

BOOK REVIEW

GUARDING MACHINES AND CIRCUITS

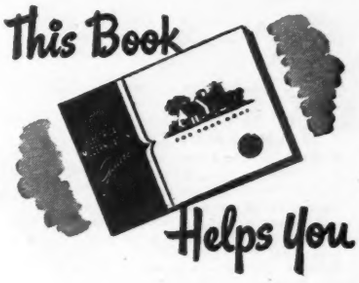
The publication of a new booklet, "Protection of Electric Circuits and Machines"; prepared by C. F. Hedlund, EE, and A. L. Brown, ME, to serve primarily as a guide for engineers of the Associated Factory Mutual Fire

GIVE A LIFT TO
home modernization
WITH G-E WIRING DEVICES

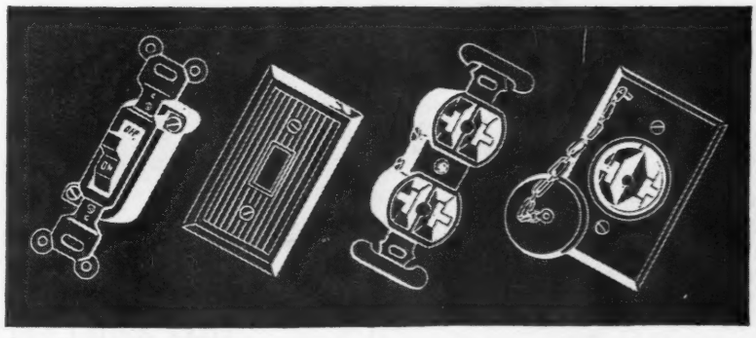
Many homes *must* be modernized electrically to make full use of new appliances and devices necessary for good living. But it's up to you to *show the difference* between a minimum-cost circuit addition and a thorough job—one that leaves the whole house "wired for tomorrow."

General Electric's full line of wiring devices can help give a lift to the job. For when you suggest *G-E wiring devices* throughout, homeowners will be assured that they are getting soundly built products, free from the quality-cutting they fear so much today.

What's more, you can use specific G-E devices to accent the modern way: Silent switches in bedrooms—waterproof outlets on porches and patios used for dining—clock outlets conveniently located.



This attractive book, *Electrical Modernization Guide*, is being offered householders to interest them in modernization of their present homes. You'll find a copy useful when discussing modernization jobs. For your copy, write Section D561-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.



G-E wiring devices are built and inspected with unusual care, to insure perfection of detail that makes for easy installation. For industrial and commercial installations, as well as homes, your use of G-E devices is convincing evidence to the customer of a long-lasting job throughout. G-E wiring devices are available from your local G-E Merchandise Distributor.

GENERAL ELECTRIC

THE LITTLE RELAY WITH BIG FEATURES

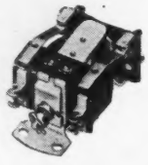
The Bulletin 104 Relay is small, yes . . . but small only in size. It will do a big job for you . . . and right where a larger relay would be hard to get in.

Large wiping contacts that carry heavy loads . . . heavy contact pressures to reduce arcing and sparking . . . wide range of voltages for both D. C. and A. C.

These are but a few of the *big* features of the little 104 Relay . . . the relay designed to meet your heavy duty requirements where weight and space are prime factors.

VARIOUS ARRANGEMENTS

Bulletin No. 104 Relays are available in Single and Double Pole, Single and Double Throw, and with or without an auxiliary contact; with fixed, flexible or adjustable contacts, with Bakelite or Radio Frequency insulation.



Write for Bulletin 104 today.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control devices since 1892

WARD LEONARD ELECTRIC CO., 28 SOUTH ST., MOUNT VERNON, N.Y.

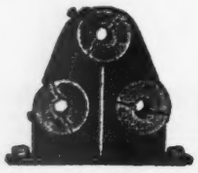
OFFICES IN PRINCIPAL CITIES

SIMPLICITY PLUS!

New **NON-INDUCTIVE CABLE RACK**

for

INDUSTRIAL PLANT WIRING



Type D-F 3-Conductor Cable Rack, New Non-Inductive Design. Racks available for Cable sizes from 5/16" to 2⅜".

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bushing.

Send today for Bulletin C-S-51 which illustrates the complete line

THE M. & W. ELECTRIC MANUFACTURING CO., INC.

EAST PALESTINE, OHIO

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS

SAVE MONEY— TIME AND LABOR

DRILLING Holes
CUTTING Openings
CHANNELING for Conduit
in
Concrete and Masonry

Write for new Catalog No. 464

SYNTRON CO.

690 LEXINGTON HOMER CITY, PA.

Insurance Companies; should prove both instructive and beneficial to all plant electricians and engineers concerned with the protection of industrial electrical machinery against short circuits and overloading. The 72-page booklet is planned to develop a clearer understanding of the need for proper protective devices in the interest of reducing the ever-increasing volume of fires having electrical origins. Those installing new equipment, extending existing facilities or revamping present electrical plans will be aided in recognizing deficiencies and determining proper remedies.

A wide variety of electrical protective devices are clearly described as to purpose, requirements, construction, characteristics, operation and advantages. Types discussed include fuses (plug, cartridge, time delays, expulsion and link), circuit breakers (air, oil, interrupting capacity), protective relays (induction, solenoid-plunger, time limit, overload and reverse energy) and overload protection for motors (thermal devices and cutouts, temperature overload relays and built-in protection).

Specific application of protective devices include generators, transformers, motors and motor circuits. Both a-c and d-c equipment is considered.

Diagrams showing typical applications of the National Electrical Code are numerous and clearly indicate the required and recommended protection of transformers and motors of varying capacity, hook-up and application.

The primary interest of the writers is that of sound protection against fire and other types of damage, the resulting reduction of unnecessary losses, and the payment of such losses as do occur. Their work provides greater safety for employees, prevents costly production interruptions and avoids the troublesome delays, the waste of resources and the many other consequences which inevitably follow all fires. Although published for manufacturing plants insured by the Factory Mutual Companies, the booklet is generally available at $2 and may be secured by addressing the Inspection Department, 184 High Street, Boston 10, Mass.

DATES AHEAD

National Modern Homes Exposition—Metropolitan Association of Real Estate Boards—Grand Central Palace, New York, N. Y., May 4–11.

Housewares Show—National Exhibition—Convention Hall, Atlantic City, N. J., May 13–17.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., May 14.

Wisconsin Electrical Association—Annual Conference, Hotel Loraine, Madison, Wisconsin, May 17–18.

National Fire Protection Association—50th Annual Meeting, Hotel Statler, Boston, Mass., June 3 to 6.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., June 11.

Pacific Coast Electrical Association—Annual convention, Fairmont Hotel, San Francisco, Calif., June 12–14.

Illinois Chapter, Western Section, IAEI—Summer meeting, Orlando Hotel, Decatur, Illinois, June 13–14.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., June 17–19.

North Dakota Electrical Contractors Association—Summer Conference—Dickenson, North Dakota, June 23–25.

American Society of Agricultural Engineers—Annual Meeting, New Jefferson Hotel, St. Louis, Mo., June 24—26.

American Institute of Technical Engineers—Summer Convention, Detroit, Mich., June 24 to 28.

New York State Association of Electrical Contractors and Dealers, Inc.—Annual convention, Saranac Inn, Saranac, N. Y., July 1–6.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Colo., July 9.

Southern California Construction Industries—Exhibition and Home Show—Pan-Pacific Auditorium, Los Angeles, Cal., July 12–21.

Pacific Coast Convention—AIEE—Seattle, Wash., August 26 to 31.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., August 13.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., September 10.

Illuminating Engineering Society—National Convention—Chateau Frontenac, Quebec, Canada, September 18–21.

Omaha Electric Show—Sponsored by the Nebraska and Western Iowa Chapter, NECA, Omaha, Nebr., September 23–28.

International Association of Electrical Inspectors—Northwestern Section, location to be announced Sept. 23–25; Southwestern Section, Hotel Sacramento, Sacramento, Calif., Sept. 30–Oct. 2; Southern Section, Asheville, N. C., Oct. 14-16; Western Section, Gibson Hotel, Cincinnati, Ohio, Oct. 21–23; Eastern Section, location to be announced Oct. 28–30.

National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., October 3–5.

National Safety Congress—Hotels Stevens, Congress & Palmer House, Chicago, Ill. Week of October 7.

International Municipal Signal Association, Inc.—Annual Meeting—Miami Colonial Hotel, Miami, Fla., October 14 to 17.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., October 8.

National Electrical Manufacturers Association—Annual Meeting—Marlboro-Blenheim and Claridge Hotels, Atlantic City, N. J., October 28 to November 2.

All Industry Refrigeration Show—Public Auditorium, Cleveland, Ohio, October 28–31.

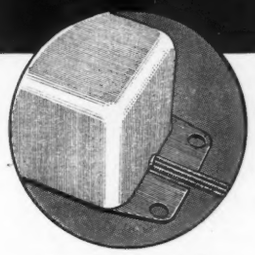
National Electrical Contractors Association—Annual Meeting, Ritz Carlton Hotel, Atlantic City, N. J., Oct. 14–18.

MANUFACTURERS NEWS

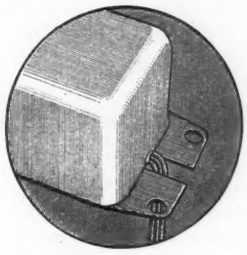
M. C. WILT NAMED PRESIDENT OF CURTIS

Melvin C. Wilt, formerly executive vice president and general manager of Curtis Lighting, Inc. was elected president of the company, at a recent meeting of the Board of Directors.

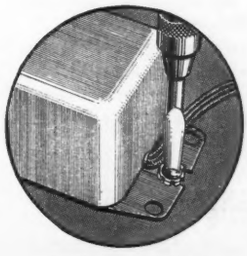
Now! the "Double 40" Ballast in a DRAWN STEEL CASE



Where ballast is mounted within the fixture, leads can extend horizontally from either end of case.



For exposed mounting of the unit, deep cut slots allow for downward extension of the leads.



Longer flange maintains standard hole centers, provides ample clearance for use of power screw driver.

The compactness, rigid strength, and clean-lined appearance of the drawn steel case construction have now been applied by Chicago Transformer to its high power factor fluorescent ballast for use with two 40-watt lamps.

Ease of installation is an outstanding feature of this new design. Deeper flanges, made possible by the more compact case, give mounting holes and slots more clearance, and improved lead exits provide for flexibility in wiring. Mounting dimensions, of course, remain standard.

And, needless to say, this new "Double 40" possesses the same high rating performance characteristics of all Chicago Transformer ballasts.

CERTIFIED ETL SPEC'N HIGH UL

ETL Certified • Underwriter Approved

CHICAGO TRANSFORMER

DIVISION OF ESSEX WIRE CORPORATION

3501 ADDISON STREET · CHICAGO, 18

There Is
A Profit for YOU
In Automatically
Turning ON and OFF
ELECTRIC SIGNS—
LIGHTING SYSTEMS

And Dozens of Other Applications with the

2200-Watt AUTOMATIC
Self-Starting TIME SWITCH
Single Pole—Model 120
$12.00

Why buy LESS
when you get the MOST
in AUTOMATICS

Prices Subject to Usual Discount & Terms

Write for Information

AUTOMATIC
Electric Manufacturing Co.
TIME SWITCHES—FLASHES
MANKATO • MINNESOTA

For FASTER, CLEANER DRYING and BAKING
install
NALCO Dritherm INFRA-RED LAMPS
FOR CONVEYOR OVENS

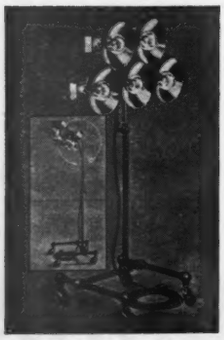
and
PORTABLE
UNITS

Wherever radiant heating energy is needed, install NALCO Dritherm Infra Red Lamps for highest efficiency and uniform controlled heating.

Nalco Infra-Red Lamps singly, in groups or in banks offer the most modern process for industrial drying, curing, baking and dehydrating.

You can count on NALCO LAMPS' reputation for long, dependable service.

See your electrical wholesaler.



Available in clear glass-type or inside-silvered, self-reflecting type.

NALCO INFRA-RED DRITHERM
NORTH AMERICAN
Electric Lamp Co.
1044 Tyler St., St. Louis 6, Mo.

Mr. Wilt replaces Darwin Curtis who becomes chairman of the board of directors. Kenneth Curtis, formerly chairman of the board, becomes chairman of the Advisory Committee.

Mr. Wilt started with Curtis in 1928, as a sales representative for Cleveland territory, and later moved to Toronto, Canada, to set up and organize Curtis Lighting of Canada, Ltd. After serving as managing director of the Canadian Company for ten years, he returned to the United States Company as vice president and general manager, in 1940. During the war, Mr. Wilt served as a Lieutenant-Commander in the Supply Corp., U.S.N.R., but returned to Curtis Lighting on being released from active duty in November 1944.

MELVIN C. WILT

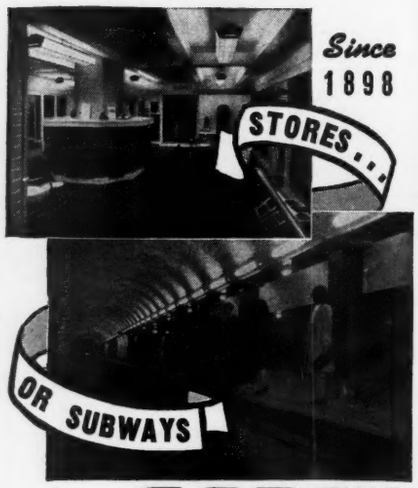
DARWIN CURTIS

Other officers elected at the meeting of the board included G. T. Morrow, vice president in charge of sales; L. H. Graves, vice president; and L. N. West, secretary-treasurer.

WESTINGHOUSE CHANGES

L. E. Lynde has been appointed manager of the New England district of the Westinghouse Electric Corporation, with headquarters at Boston, Mass. Sidney C. Palmer has been made manager of the transportation and marine division and F. S. Bacon central station manager for the district.

Franklin L. Snyder has been named engineering manager of the Sharon transformer division. A. C. Farmer, who for the past five years has served as assistant to H. V. Putnam, vice president and manager of the transformer divi-

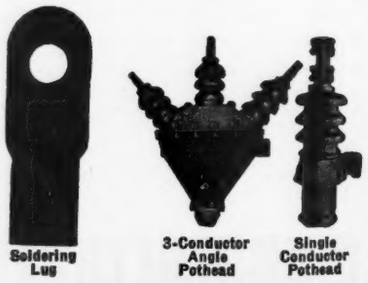


It's GARCY
for better lighting

Check the outstanding lighting installations of the country in stores, offices, hospitals, banks, factories — even subways—and you will come across GARCY lighting with amazing frequency. Specialized reflectors, strip lighting, troffers, ceiling fixtures, every GARCY item carefully designed and thoroughly engineered for maximum beauty, efficiency, utility. Catalogs available.

GARDEN CITY PLATING & MFG. CO., INC.
OGDEN BLVD & S. TALMAN AVE.
CHICAGO 8, ILL.

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC
FROM STOCK



Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14760 Birwood Avenue • Detroit, Mich.

sion, now becomes assistant to Mr. Hodnette, manager of the Sharon transformer division.

Mr. Hodnette has announced the organization of a specialty transformer department. Chris H. Bartlett has been appointed manager; A. E. Black is general foreman; and Frank E. Baker becomes section engineering manager. The specialty transformer department will be responsible for the engineering, manufacture and sale of radio and other electronic transformers and specialty transformers of similar character.

Frank C. Cline has been appointed manager of the Southwestern district of the Westinghouse Lamp Division.

Roy L. Brown has been named manager of the Eastern district of Westinghouse Electric Supply, with headquarters in New York City. Branches included in the district are Newark, Trenton, Jamaica and Hempstead.

WESCO has formed a new district in the central part of New York state with H. B. Tompkins as manager. With headquarters in Rochester, the new district will embrace Albany, Binghamton, Syracuse, Utica and Watertown. Other appointments are Robert H. Douglas, service manager; B. T. Tremaine, promotion manager; H. K. Gleichauf, stores manager, and F. S. Jones, credit manager.

AMERICAN STEEL & WIRE PERSONNEL CHANGES

Two major changes in the management personnel of American Steel & Wire Co., a U. S. Steel Corp. subsidiary, have been announced. John May, vice president in charge of sales, has been appointed assistant to the president to aid in general commercial and sales policies. Mr. May is succeeded by Harry M. Francis, who has been elected vice president in charge of sales. Mr. Francis was assistant vice president.

H. M. FRANCIS

B. M. Ashbaucher has been appointed manager of the electrical, wire rope and construction materials department of the New York sales office. C. W. Meyers has been named assistant manager of the wire rope and construction materials division of the company's general sales department in Cleveland to succeed Mr. Ashbaucher.

FULLMAN Latrobe PRODUCTS

FLOOR BOXES — WIRING SPECIALTIES

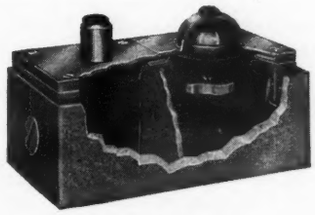
Choose "Latrobe" Products for quick installation and lasting service. They're economical, too. Save time, labor, money.

NO. 110 "LATROBE" WATERTIGHT BOX

The iron box body has 3½" round brass cover plate. Shown with No. 208 Receptacle and No. 207 Bell Nozzle.

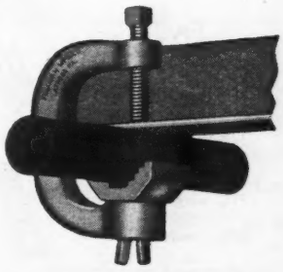
NO. 284 NOZZLE WITH NO. 200 COVER PLATE

Very Neat and durable is this Duplex Receptacle Nozzle—½" or ¾" brass pipe extension.



NO. 252-R FLOOR BOX

This two Gang Box has our No. 208 Receptacle in one section. One cover plate has ½" Brass Plug and one a 2" Brass Plug.



NO. 470 "LATROBE" PIPE OR CONDUIT HANGER

Designed especially for hanging pipe or conduit ½", ¾" and 1" to steel beams up to ⅜" thick. Will not rattle loose.

"BULL DOG" INSULATOR SUPPORTS

Safe and efficient for fastening porcelain or glass insulators to exposed steel framework. Made in several sizes.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

Here's a New
POWER CUTTER KIT
with a cutting range of
5/8" to 2 1/2"

Only $7.85 Complete

Two Bruno Adjustable Hole Cutters in one convenient kit. High speed steel blades cut clean, fast holes in metal, wood, plastics. Quickly adjustable and easily sharpened. Designed by tool engineers to operate efficiently in bench drill, drill press or portable drill.

Ask your jobber, or write Department EC-5

POWER CUTTER KIT CONTAINS

MODEL	SHANK SIZE	EXPANSION	PRICE
100	1/4" st. shank	5/8"—1 1/2"	$3.00
101	3/8" st. shank	1"—2 1/2"	$5.00
790 KIT		5/8"—2 1/2"	$8.00*

*Fair Trade Minimum $7.85

BRUNO TOOLS
9330 Santa Monica Blvd.
Beverly Hills, Calif.

Fill out and mail for 48-page illustrated catalog.

NAME_____

Firm Name_____

Address_____

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

G-E APPOINTMENTS

Miss Lillian E. Eddy has rejoined the staff of Atlantic Sales District of General Electric's Lamp Department in New York City. Miss Eddy was absent from her lighting activities during the war years while she was moving about the country with her husband, a radar specialist. Miss Eddy's activities with the New York office will include the design of new residential lighting installations, assistance to manufacturers in the design of residential lighting equipment, service to decorators and architects, training of home lighting advisors, and preparation of papers and lectures on home lighting.

R. E. Joines has been named acting manager of construction materials sales for the General Electric Company in the Southeastern District, with headquarters in Atlanta.

The following new district representatives have been appointed for construction materials sales—W. W. Bryan, Arnold Jensen and H. K. Kowal, with headquarters in Philadelphia; Jack Peevey in Houston; Rex Becker in Omaha; R. C. Holmquist in Denver; R. O. Snyder in St. Louis; O. A. Kirkland, E. R. Broughel and Clarence Van Etten in New York; Hayden McAfee in Boston; R. A. Cochran in Nashville; J. M. Murphy in Jacksonville; A. W. Metheny in Atlanta; W. R. Rivers in Los Angeles; and Robert Farian in Chicago.

E. J. McFadden, recently returned after more than three years' service in the U. S. Army, has been appointed sales manager for G-E water heaters.

ILG APPOINTMENTS

Bernie G. Silberstein, manager of the Ilg Electric Ventilating Co. branch office in Cincinnati, Ohio, has been appointed Ohio Valley District manager. He will supervise engineering and sales activities of Ilg branch offices in Cincinnati, Columbus, Louisville, Knoxville and Charleston, W. Va.

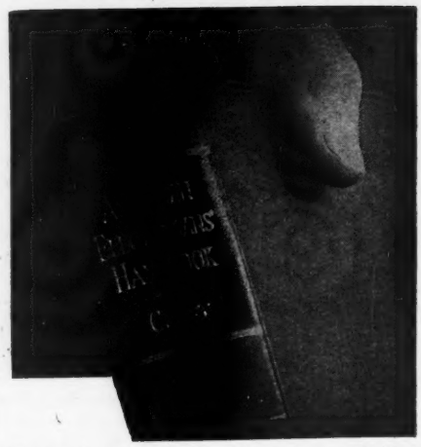
E. J. Stone has been appointed manager of the Detroit office as a successor to A. H. Kirkpatrick. Capt. W. L. Hochschild has become associated with the Chicago branch office as a sales engineer. John D. Briggs has been assigned to the branch office in Philadelphia, Pa. and William S. Gorham has been appointed sales engineer in the Los Angeles, Calif., branch office.

CORNING GLASS CHANGES

Amory Houghton, chairman, Corning Glass Works, Corning, N. Y. has announced changes in the executive staff of the company, the election of three new directors and an executive committee.

William C. Decker, vice president, was elected president, succeeding Glen W. Cole, who was made vice chairman of the Board of Directors. Charles D. LaFollette was named treasurer, and will

Get the right answer
FAST—for more efficient more profitable handling of
EVERY TYPE OF PRACTICAL ELECTRICAL JOB



Thousands of men have used previous editions of this famous handbook as a working guide of everyday usefulness. Now it is ready to help you too, in a big 5th edition—600 pages larger—brought up to date—*more than ever the one great pocketbook of practical electricity for you.*

5th Edition

Croft's AMERICAN ELECTRICIANS' HANDBOOK

Revised by CLIFFORD C. CARR
Head of Electrical Engineering Department, Pratt Institute

THIS book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. From clear explanation of the fundamentals of electricity, to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men select and install commercial electrical apparatus and materials intelligently for the performance of specific services, operate electrical equipment efficiently, and maintain it at high operating efficiency.

1600 PAGES OF practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 5 x 7¼. 1177 illustrations.

PRICE ONLY $5.00

COVERS:
- conductors
- circuits and circuit calculations
- general electrical equipment and batteries
- generators and motors
- transformers
- outside distribution
- interior wiring
- electric lighting
- etc.

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C. 18
Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders. Same return privilege).

Name .....
Address .....
City & State .....
Company .....
Position ..... EC. 5-46

For Canadian prices write Embassy Book Co., 12 Richmond St. E., Toronto 1

continue in his present position as vice president and director of sales. Eugene W. Ritter, vice president, together with Messrs. Decker and LaFollette, were added to the board. John L. Ward, formerly treasurer, was made manager of the bulb and tubing division of the company.

Dr. Eugene C. Sullivan, formerly vice chairman of the board and director of research, was elected honorary vice chairman. Dr. Jesse T. Littleton, vice president and associate director of research, was designated director of research. Mr. Houghton will serve as chairman of the executive committee.

CINCH BUYS HOWARD B. JONES CO.

Lester W. Tarr, president of Cinch Manufacturing Corp., has recently announced the purchase of the Howard B. Jones Co., Chicago. This plant will be known as the Howard B. Jones Division, and will continue the manufacture of Jones plugs, sockets, terminal strips, fuse mounts, etc.

Cary Wilson, vice president of Cinch Manufacturing Corp., heads the manufacturing activities of the new organization as general manager.

MILLER NAMED PRESIDENT OF FEDERAL ELECTRIC

At a recent meeting of the board of directors of the Federal Electric Company, Inc., Chicago, Linwood A. Miller was elected president to succeed the late Charles Borland. All other officers were reelected. For the past four years Mr. Miller has been in government service as Deputy Regional Director of the War Production Board and chairman of the Army Air Force Price Adjustment Board. Prior to entering government service Mr. Miller was president of The Willys-Overland Company.

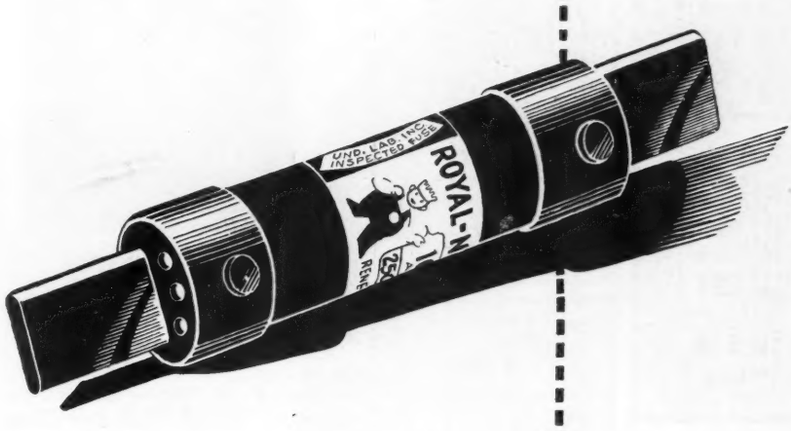
GRAYBAR CHANGES

A. W. Palin, Jr. has taken over the duties of Mississippi Valley district operating manager for the Graybar Electric Company. He will be located at district headquarters in St. Louis. He succeeds J. R. Ernest, who has moved to Seattle to be operating manager of the Northwestern district. He replaces C. R. Bean, who is retiring.

Graybar has opened new offices and warehouses in Wilmington, Delaware, at 1005-1007 West Fourth Street. L. E. McIntyre has been named manager.

A new office has been opened at 701 East Third Street, Amarillo, Texas, with L. P. Bell as the manager. Also a new office and warehouse has been opened at 758 Ricks Street, Jackson, Miss., and A. N. Saxon has been appointed manager.

ROYAL-NOARK
Non-Renewable
CARTRIDGE FUSES



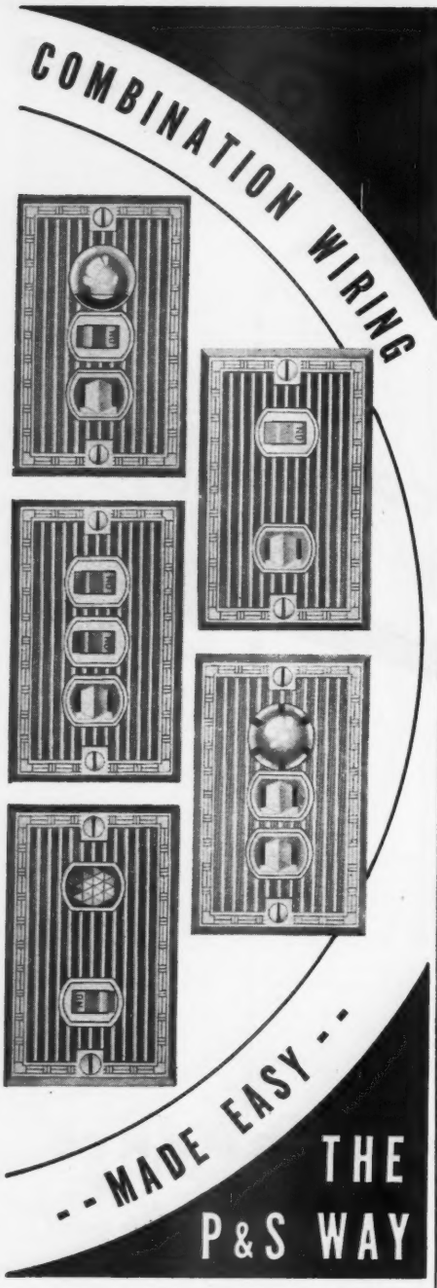
5-WAY BETTER PERFORMANCE

Better . . . 5 ways better! Five engineering improvements in the design and construction of Royal-Noark Non-Renewable Fuses mean that they stay cooler . . . give greater protection to vital equipment. Complete detailed catalog information is yours on request, and prompt deliveries on your orders.

ROYAL

WIRE • CORD SETS • CARTRIDGE and PLUG FUSES • FUSTATS • TROUBLE LIGHTS • CHRISTMAS LIGHTING SETS

ROYAL ELECTRIC CO., Inc., PAWTUCKET, R. I.



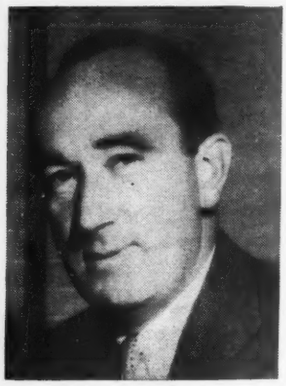
Hard-to-get combinations are a cinch — All you need is a small stock of P&S - Despard Wiring Devices and a screwdriver. Presto! A neat, modern assembly of switch and outlet, switch-controlled night light (with an extra outlet), pilots and switches, pilots and outlets—whatever is needed to make the wiring system complete and up - to - date. Saves boxes. Saves Plates. SAVES TIME.

Sold Thru Electrical Wholesalers

PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

THERMADOR APPOINTMENTS

Thermador Electrical Manufacturing Company, Los Angeles, Calif., has announced the appointment of William E. Cranston as president. Mr. Cranston, formerly vice president and general manager, succeeds Harrison H. Fogwell, who has become chairman of the board.



W. E. CRANSTON

Other appointments are Clyde I. Harding as vice president in charge of production; F. M. Pence, vice president in charge of engineering and Frank A. Ballman, vice president in charge of sales.

HERBERT NOCK JOINS A. L. SMITH IRON CO.

Herbert Nock has been appointed sales manager of the A. L. Smith Iron Company, Chelsea, Mass. Mr. Nock is well known for his long association with General Electric's apparatus department, time switches and timing devices. In his new position, he will be responsible for sales of Smithcraft fluorescent lighting fixtures.

H. NOCK

ALLIS-CHALMERS APPOINTMENTS

R. H. Porterfield has been appointed manager of a new branch office of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., in the New England district located at 1607 Industrial Trust Bldg., Providence, R. I. R. E. Scudder, who served as a U. S. Navy aviator during World War II, has been assigned to the new Providence branch as salesman.

Joseph Bronaugh has been named manager of a newly established Miami branch office at 1404 Postal-Pacific Building.

AMERICAN TRANSFORMER APPOINTMENTS

American Transformer Company of Newark, N. J. announces the appointment of Thomas M. Hunter, president and treasurer, Walter Garlick, Jr., vice president, John M. Wollmer, comptroller and secretary and William R. Smith, works manager.

The electronics and aircraft products section is under the supervision of John F. Harris; power, distribution and liquid-filled transformers under Walter Hoehn and specialty air-insulated transformers and transtats under Theodore W. Stauber.

METROPOLITAN DEVICE NAMES NEW AGENTS

Metropolitan Device Corporation of Brooklyn has appointed three new agents. I. E. Cope & Co., Thomas Building, Dallas 1, Texas, will cover the Texas area; Southwest Sales & Service Co., 310 Commercial Bank Bldg., Shreveport 24, La., will cover the states of Louisiana, Arkansas, Mississippi and western portion of Tennessee; and S. T. Schoolar & Co., 5 Shockoe Slip, Richmond 19, Va., will cover the state of Virginia, with a portion of North Carolina and a portion of West Virginia.

•

Fred W. Wakefield has been appointed resident engineer at Chicago for the **F. W. Wakefield Brass Company,** Vermilion, Ohio. He succeeds the late Norman Hickox and Mr. Wakefield's territory consists of northern Illinois, northern Indiana and eastern Iowa and Wisconsin.

•

Charles E. Bunting was elected chairman of the board of directors of **The Bunting Brass & Bronze Company** of Toledo, Ohio, at the annual meeting of the company. George H. Adams, formerly executive vice president was elected president and Walter F. Volk secretary and treasurer.

•

The Emerson Electric Mfg. Co., St. Louis, Mo., is moving all manufacturing and office facilities from its downtown buildings to the 5 million dollar plant which was erected under Emerson Electric's supervision for the development and manufacture of airplane gun turrets

during the war. The plant is located at 8100 Florissant Ave. and the entire move is scheduled for completion in September.

•

Square D Company of Detroit is building a new west coast division plant in Los Angeles for the manufacture of control and electrical distribution equipment, to replace the one now in operation. J. H. Pengilly, vice president of Square D, is general manager of the West Coast division. He recently returned to the company after wartime service as a colonel of engineers.

•

After four years' service in the Army Air Forces, Major L. H. Mingins has rejoined the sales organization of the **Webster Electric Company,** Racine, Wis., as its representative in the Metropolitan New York, New York State and New Jersey area.

•

The Allen-Bradley Company of Milwaukee, Wis., has moved its Boston office to larger quarters at 55 Oliver Street. M. H. Hallenbeck remains as district manager assisted by Charles M. McCoombe.

•

Feedrail Corporation, New York City, has announced the appointment of Robert J. Nelson as northern Ohio representative. Mr. Nelson's office is at 1935 Euclid Avenue, Cleveland 15, Ohio.

•

Bulldog Electric Products Company of Detroit, Mich. announces the creation of a new Cincinnati District suboffice in Louisville, Ky., with Fred Bush in charge.

•

Harris Reinhardt has been named manager of the commercial engineering department of **Sylvania Electric Products Inc.** lighting division. Mr. Reinhardt has been with Sylvania since 1940 and prior to that was affiliated with the Westinghouse Lamp Division.

•

Albert J. Hulse, formerly with Carnegie-Illinois Steel Corporation at Pittsburgh, has joined **The Youngstown Sheet and Tube Company** of Youngstown, Ohio, as chief engineer.

•

Acme Electric & Manufacturing Co. of Cuba, N. Y. has named A. J. Weilbascher of 303-A Levert Building, 823 Perdido St., New Orleans, La. as sales representative in Louisiana, Mississippi and western Tennessee.

Monarch Fuse
SPRING CLIPS

FERRULE TYPE

KNIFE BLADE TYPE

Prevent Fuse Failures Due to Terminal Heating

Tighten Fuse Contacts

Monarch DOUBLE END WRENCH

Users of Monarch Renewable Fuses are provided with this ingenious wrench . . . designed to fit nuts on any and all sizes of our fuses.

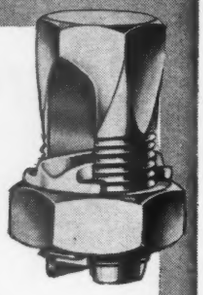
MONARCH FUSES Are Available Through RECOGNIZED WHOLESALERS

Specify Monarch Fuses *for improved*

FUSErvice

MONARCH FUSE CO., LTD.
116 E. FIRST ST., JAMESTOWN, N. Y.

Conductor Fittings



Service Connectors of all sizes and types —Yoke - and - Nut Type from No. 10 to 1,000,000. Also Service Entrance Connectors, Service Post and special connectors.

Penn-Union also makes a *complete* line of Tee Connectors; Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Supports; Grounding Clamps, Lugs, etc. etc. *Leading users have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

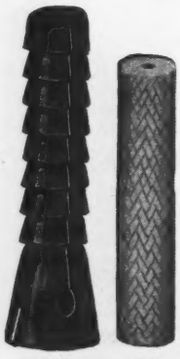
PENN-UNION ELECTRIC CORP.
ERIE, PA.

PENN-UNION

PAINE Woodscrew ANCHORS

TAKE HOLD
IN MASONRY and CONCRETE

LEAD AND FIBER TYPES



Use Paine Woodscrew Anchors for bushing woodscrew holes — for fastenings in brick, tile, marble, slate and wood furring—and for miscellaneous carpentry jobs. They are inexpensive, dependable and easy to use. For quick installation, simply place anchor in hole, insert woodscrew and tighten. No setting tool is needed and hole need not be plumb. Both fiber and lead types expand uniformly as screw is tightened. Available in a wide variety of sizes.

950 955

Ask your Supplier or Write for Catalog.

THE PAINE CO.
2961 CARROLL AVE., CHICAGO, ILLINOIS
Offices in Principal Cities

PAINE
FASTENING and HANGING DEVICES

William G. Hall, who has been in charge of renewal parts and repairs for **The Reliance Electric & Engineering Company** during the war years, has been made manager of a combined renewal parts and service division. Mr. Hall succeeds Arthur W. Ray, who has retired.

•

The Thomas & Betts Company, Inc. of Elizabeth, N. J. has announced the appointments of Fred M. Shepard as district manager of its Cleveland territory and Wyman Elliot as district manager of its Atlanta office.

•

Reuland Electric of Alhambra, Calif., has announced the sale of the Reuland small motors division to the **Rheem Manufacturing Company** for use in their own products.

•

J. O. Eaton, chairman of the board of the **Eaton Manufacturing Company,** Cleveland, Ohio, has announced his company's acquisition of all outstanding shares of Dynamatic Corporation, Kenosha, Wis.

•

The John A. Roebling's Sons Company of Illinois is erecting a new office building and warehouse at 5525 West Roosevelt Road, Chicago.

•

Jay L. Mann has rejoined the **Electro Manufacturing Company** of Chicago as a lighting consultant, after three years in the U. S. Signal Corps.

•

General Controls Company, Glendale, Calif., has announced the appointment of Edward B. Maire as manager of the Chicago factory branch, 822 South Michigan Ave., Chicago, Ill.

•

Champion Lamp Works, Lynn, Mass., announces the appointment of Fred J. Vorlander to head the company's lamp and lighting application activities.

•

James G. Biddle Co. has moved its offices and factory to 1316 Arch Street, Philadelphia 7, Pa.

•

John J. Conners has resigned as general sales manager of the Irvington Varnish & Insulator Company, to become vice president and sales manager of the **Bishop Gutta Percha Company,** New York City and the **Peters Manufacturing Company,** Wollaston, Mass.

FLUORAINE

FLUORESCENTS BY MULTI

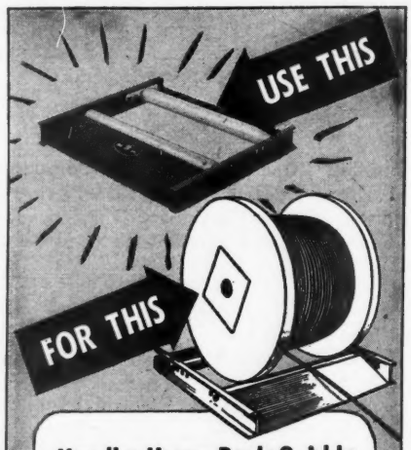
FLUORITE

REFLECTORS FOR GENERAL OR LOCALIZED LIGHTING

MULTI Fluorescent Reflectors give you the modern method for taking care of industrial and residential installations. Our complete line contains the proper unit for any and all needs.

Send for our complete catalog

MULTI
ELECTRICAL MANUFACTURING CO.
4223 W. Lake St., CHICAGO 24, ILL.



Handles Heavy Reels Quickly . . . Safely . . . Economically

Saves time and money in the plant, warehouse or on the job.

Roll-A-Reel is the ideal way to reel or unreel wire, cable, or rope and does an easier, better job in every way.

In two sizes . . . 2000 lbs. capacity—$37.50 and 4000 lbs. capacity — $75.00 F.O.B. Cincinnati.

Send for descriptive pamphlet.

ROLL-A-REEL
327 WEST FOURTH STREET
CINCINNATI 2, OHIO

NISA MEETS IN TAMPA

[FROM PAGE 67]

in labor and material costs, *if* O. P. A. finds that such price adjustments are necessary and approvable, Mr. Wheeler stated. He also pointed out that EO 9697 *requires* advance approval by the proper government agency of all increases in wages and salaries, *if* such increases are to be used as a basis for an application to O. P. A. for an increase in price ceilings.

Vaughen's Pricing Service. C. B. Kaska, Chicago Electric Co., Chicago, presented a short discussion of Vaughen's Pricing Service.

Future Problems in Fractional Motors and Parts. A. H. Barrere, Jr., Russell Electric Co., Inc., Mobile, urged the fractional motor repairmen to bring their respective organizations in step with the advances of this modern age, operate efficiently, give real service, and be qualified to represent one or more manufacturers for his service. So long as this is done, he said, no manufacturer will go to the trouble and expense of setting up the necessary capital expenditures in buildings, land, shop equipment, stock and office equipment.

An exchange plan on stators, armatures, and even complete motors would help the fractional shops, Mr. Barrere stated, though it has limitations, particularly in costs. He concluded that the fractional motor shop's future will be successful, since motor manufacturers realize the major role of such shops in helping them maintain their own integrity and service.

Disposal of Government Surpluses. W. W. Hanks, Southern Electric Service Co., Charlotte, submitted a report of the War Surplus Committee, covering activities of that Committee during the past year. As chairman of that Committee, Mr. Hanks reviewed actions taken with R. F. C., its successor, War Assets Corporation, and finally with War Assets Administration, in an effort to develop a definite dealer agreement whereby the electrical repair shop industry would be appointed as approved dealers for electrical equipment as defined, and a sales discount allowed, as was done in the case of the agreement between WAA and the Machinery Dealers National Association. NISA War Surplus Committee was informed, however, that no such agreement can now be worked out, as the WAA legal department will not approve any other such contracts.

Mr. Hanks advised that the expected flood of surplus electrical equipment has not yet developed, and priority buyers

For the first time in over four years we are now able to quote immediate delivery on U. S.-made hand-cranked "Megger" Insulation Testers.

Not until war came did anyone realize the tremendous number of insulation testers that were going to be needed, nor what a vital place "Megger" instruments were to have in the picture. Now that our Philadelphia factory has been in full production for nearly three years, these heavy demands have been met, and we can again invite orders from both old and new customers alike. We take pride in being able to offer the same rugged and dependable "Megger" instruments in various ranges up to 2000 megohms and with hand-cranked d-c generators up to 1000 volts. We continue to supply other types and ratings of "Megger" instruments as formerly.

If you are uncertain which type and range of insulation tester is best for your particular needs, write us, telling the type, size and rating of your equipment. We will gladly make recommendations. Also ask for illustrated Bulletin 1735-EC.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

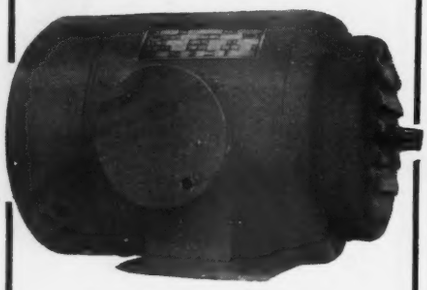
Insulation Testers, Ground Testers, and Ohmmeters

JAMES G. BIDDLE COMPANY

1316 Arch Street • Philadelphia 7, Penna.

MOTORS, A.C. & D.C.

Immediate production on 1/4, 1/3 and 1/2 H.P. direct current motors; also A.C. motors, 1, 2, 3 and 5 h.p., single phase, repulsion induction.



¼ H.P. Direct Current Motor

Also manufacturers of A.C. generators, 500 watts to 125 K.W., rotary converters, motor-generators, high frequency generators, etc.

Katolight engineers have developed a lot of know-how. Give us a chance on your special requirements.

KATO ENGINEERING COMPANY,
1416 FIRST AVE. MANKATO, MINN.

LIGHTING GIVES YOU FOOTCANDLES THAT WORK

A Great Line for
SERVICE STATION—SPORTS—AIRPORT INDUSTRIAL and MARINE SERVICE

16-18-24 in. Floodlight for Airports

No. 420 Enclosed Flood for Lighting playgrounds, pools, airports, gas stations, etc.

A Triangular Flood for corner Locations. A Revere development. Solves property line cut off.

The Famous Hinged Pole

Write for Catalog Data

REVERE ELECTRIC MFG. CO.
6017 Broadway — Chicago 40, Ill.

are now taking the total supply of such offerings as are made.

Shop Session

Thirteen papers were presented under the Shop Session, chairmanned by Jos. F. Ferrari, Excell Electric Service Co., Chicago.

General Management of Fractional Service Shops. Volume is an absolute necessity to the success of any small motor shop, and operators of fractional service shops should pay proper attention to management in order to keep a good volume of work coming to their benches, M. G. Miller, Tennessee Electric Motor Service, Knoxville, told the convention group.

General Management of Shops Doing Large Work. George Larsen, Engineer, R. A. Reed Electric Co., Los Angeles, gave the following prerequisites for a growing industrial electrical repair shop:

1. Location must lie in a heavily concentrated industrial area to provide necessary volume of repair work, and to minimize distance over which the equipment must be transported to and from the shop.

2. The owners and managers must have a driving urge and desire to grow and to continually improve all phases of the operation.

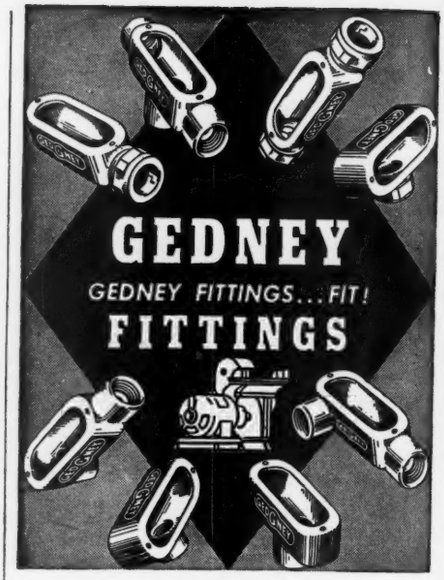
3. The owners and employees must be willing to make continual personal sacrifices in money, time, and convenience.

Shop Cleanliness and Orderliness. J. W. Wilson, Wilson Electric Company, Macon, Georgia, discussed ways of promoting shop cleanliness and orderliness, and the effect of such cleanliness on the morale of the employees, as well as the good effect on customers.

Stator and Armature Stripping. J. Arthur Turner, Sr., Tampa Armature Works, Inc., gave a detailed procedure on the removal of old or damaged windings from armatures and stators. He stressed the importance of records on data cards before removal of old windings from rotating apparatus.

Winding and Connection Time. George P. Svendsen, Boustead Electric & Manufacturing Company, Minneapolis, pointed out that rewinding time rates based on horsepower and speed rating are dangerous to use in setting actual workers' rates, or in a worker's point rating system for bonus payments.

Women's Part in Service Work. Miss Iyla Tracy, A. S. Tracy, Concord, New Hampshire, advised that women can be trained to perform many jobs in the service shop. She recommended use of women in shops handling motors in sizes up to 5 hp., supervised by a foreman



GEDNEY Conduit Bodies and Fittings are available for every wiring need. Complete lines of both threaded and threadless fittings are included. All are carefully finished, protectively packed in metal-edge cartons, clearly marked for time saving on the job, GEDNEY fittings are Underwriters Laboratories approved. Write for catalog.

GEDNEY ELECTRIC COMPANY
RKO BLDG., RADIO CITY, NEW YORK, N. Y.

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street, New York, 18, N. Y.

who is unprejudiced against women as workers.

Brazing Armature and Stator Connections. O. P. Clot, Peninsular Armature Works, Miami, said he had found low temperature brazing saves times in connecting stators wound with No. 20 wire and larger.

Short Cuts in Rewinding. C. R. Durand, of H. N. Crowder Jr. Company, Allentown, Pa., recommended recording of winding data, with proper notation of the coil extension and position of the lead wire, in addition to number of turns, wire size, connection and span of the coil, on data cards as standard routine to save time.

Tricks in Coil Making. Wm. S. Giles, of Giles Armature and Electric Works, Marion, Ill., picked two "tricky" coils and explained how they are made in his shop. One was the "double knuckle coil", and the other was the "layer-built stator coil", made of round, square or rectangular magnet wire with a minimum of crosses.

Costs Other Than Rewinding. L. H. Lanahan, Tri-State Armature and Electric Works, Inc., Memphis, Tenn., reviewed the many operations in a service shop, pointing out the difficulty of segregating such work from rewinding and making separate charges for this work.

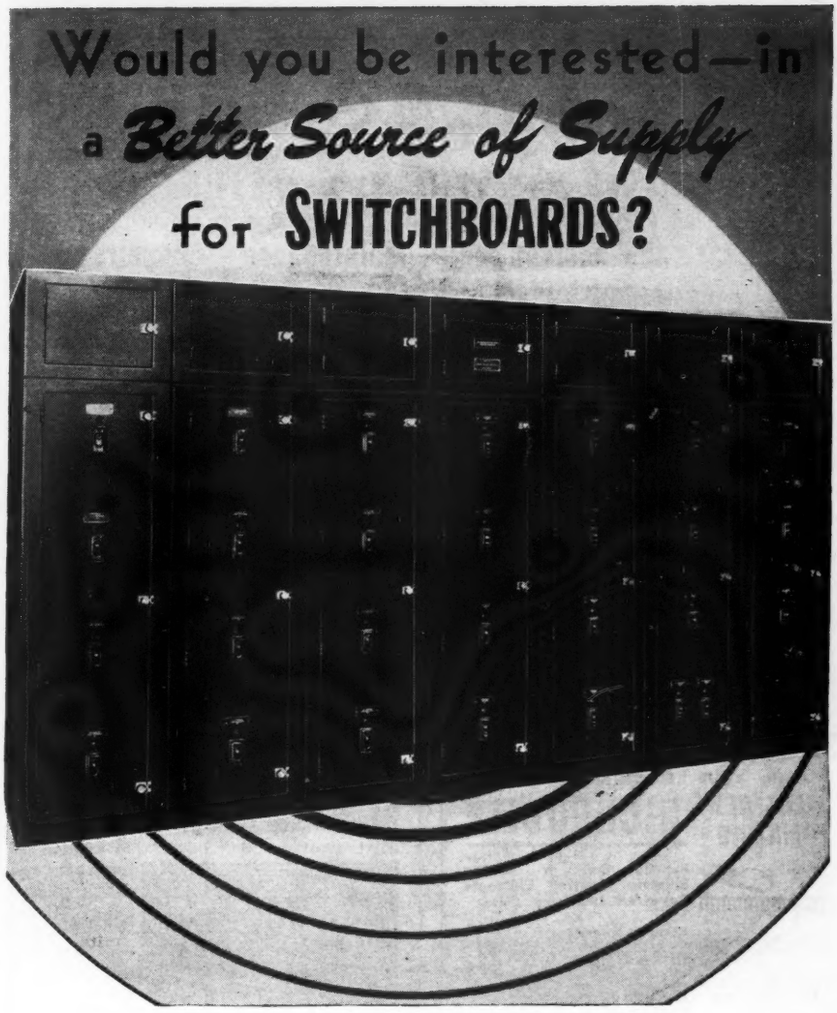
Tests of Serviced Equipment. Arthur Wagner, Sr., of Arthur Wagner Co., Chicago, discussed test procedures and short cuts covering serviced equipment.

New Equipment and Tools. Mass production is a tool, it was pointed out by H. F. Baker, Savannah, Ga. Mr. Baker also discussed machine tools normally employed in motor repair shop, doing a round-up on testing equipment devices, new winding machines, conveyor systems, dynamometers.

Small Gadgets and Time Savers. Wm. H. Braunlich, Braunlich-Roessle Co., Pittsburgh, passed on to the membership fourteen practical ideas.

The afternoon of the second day was devoted to a business session, with Wm. H. Braunlich, President, presiding. This session was devoted to reports of officers and committees, old and new business, and election of officers for the coming year.

R. B. Turner of Windsor, Ontario, 1945 vice president, was elected president for the coming year. Other officers elected were: R. E. Ward, Raleigh, N. C., vice president; H. E. Grant, Nashville, Tenn., re-elected secretary; and S. F. High, Cincinnati, Ohio, re-elected treasurer. New directors appointed were: Fred Ferris, Boston, Region 1; and S. F. High, Cincinnati, Region 7.



Engineering Service that's Unusually Helpful. No matter how difficult your problems of design, our engineers have probably solved them . . . exceptional experience in planning every kind of switchboard and special panelboard. We take full responsibility for meeting all applicable specifications and requirements.

Highest Quality, Exclusively. The best of materials and skilled workmanship, backed by rigid engineering inspection. Every Pelham switchboard and panelboard is guaranteed to give completely satisfactory service.

Dependable Deliveries. Special switchboards are designed and built with unusual promptness. Our deliveries are made when promised.

Call your Pelham representative, or write or wire the factory.

PELHAM ELECTRIC MANUFACTURING CORP., ERIE, PA.

SPECIALIZED DESIGN

Pelham

UNEXCELLED QUALITY

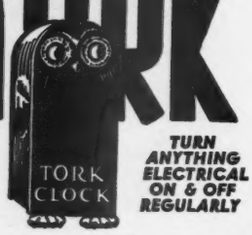
SWITCHBOARDS • PANEL BOARDS • SWITCH GEAR AND ACCESSORIES

WHERE TO BUY

Equipment, Materials and Supplies for

Electrical Construction — Maintenance — Repairs

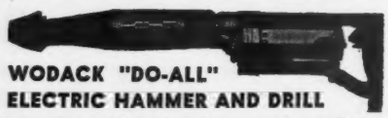
TORK



TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

DRILL CONCRETE THE EASY WAY

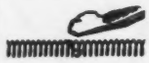


WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL

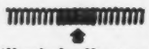
Saves time and labor installing expansion anchors. Two motions—reciprocal for hammer drilling—rotary for twist drilling. Drills masonry to 1⅝". dia., metal ⅝". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, bull points, etc. Ask for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago 44, Ill.
Telephone AUstin 9866

REPAIR YOUR ELECTRIC APPLIANCES
WITH NEW AMAZING NICHROCITE



Burned Out or Broken Electric Heating Elements Repaired Instantly . . .



Handy for Home or Industrial Use

Simply overlap ends, apply Nichrocite paste and turn on the current — a perfect weld results. Used by big utility companies and repair shops. Just the thing for that broken or burned out heating element in your electric iron, stove, toaster or heater. Does the job in a jiffy. Trial order, $1; 4 ozs. $2.50; 1 lb. $8.00.

Armstrong Electric Co., Box 861-EC, Minneapolis, Minn.

LAMP ANNUNCIATORS

Kirkland Bulls-I-Units are ideal for building lamp annunciators. Just provide the proper size holes in the panel, then insert the Kirkland units and lock into place. Assembly is then ready for installation. Connect incoming wires and place in service. *WRITE FOR CATALOGUE.*

THE H. R. KIRKLAND CO.
811 KING ST., MORRISTOWN, N. J.

Speed Reconversion with a

KUEHL FISH TAPE GUN

A Pusher . . . A Puller
A Reel . . . A Fish Tape

The fish tape is pushed, pulled, wound and unwound by simply pumping the handle. One man can pull as much as three with the Kuehl Fish Tape Gun. It offers a 3 to 1 mechanical advantage.
Write for descriptive bulletin.

D. S. KUEHL & SON
Clio Michigan

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

This WHERE TO BUY *Section*

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

Classified Advertising Division, ELECTRICAL CONTRACTING

WHAT IS THE MARKUP? PART II

[FROM PAGE 76]

for each dollar of base cost the selling price would be:
[1.00 (base cost) + 22 percent] + 10 percent = 1.34

Remember that this 22 percent represented 11.39 percent on material and 38 percent on labor.

Now suppose the contractor took an installation-only project and again used 22 percent to cover all job costs. The selling price would again be $1.34. Since only labor was sold, the operating costs would be 38 percent and for each dollar of base cost there would be a job cost of $1.38. The contractor would be selling something for $1.34 that actually cost him $1.38. That certainly is trying to make money the hard way.

It might be well, at this point, to call attention to two special items of expense encountered on installation-only jobs. In estimating such work, allowances must be made for:

1. Material service (materials furnished by owner).
2. Increased labor due to procurement failures.

The full explanation of these costs is too involved to be elaborated on here.

Some owners want to furnish all the material and others want to supply the cream of it and let the contractor include the remainder in his contract. In either case we get back to the same answer for accurate estimating: Separate markups.

Contractors' Objections

Many contractors voice objections to the separate markup method. The three principal ones are:

1. They are not accustomed to this practice.
2. Labor will object to having such a high burden charged against it.
3. It is difficult to segregate charges and estimating will become too involved.

Objection One—This is easily understood. It is not good practice for anyone to change his business practices without being sure of his ground. A contractor should start out by first estimating his work in the way he is accustomed to doing it. The separate markup method will serve as a guide until he gets his bearings. It is safe to say that after carefully studying his operating costs a contractor will be more than happy to have an accurate scheme of estimating.

Some few contractors who were using the common markup method of a year

ago have now reached the point where they advocate charging all the operating costs to labor. This method, too, has its faults. That is another one of the sidelights which comes under the classification "too numerous to discuss here."

Objection Two—Why should labor in the electrical business object to having work estimated accurately? Contracting is its bread and butter and it goes up and down with the business. Other mechanics do not object. You never hear the lathe operator complain because his work has to carry a burden of 100 percent or more.

Labor should feel flattered that its services are valuable enough to warrant such expenditures. *Besides, overhead and job costs are not labor charges; they are service charges.*

If the labor rate is $1.50 per hour, that is all the contractor has a right to charge for it. Anything over and above the $1.50 should be for service charges and return. A buyer may be billed $2.50 for every hour the mechanic works, but of this amount, there is only $1.50 included for the man's actual labor. The remainder has to be added so that the work the mechanic is doing can be expeditiously carried on.

Engineering, supervision, drafting, and tools, all represent a service expense necessary in good construction practices. As shown in the previous article, all such expenditures lead to better jobs and savings to the buyer.

Objection Three—With all the charts, figures, and talk, it does seem that we are setting up a fantastic and unwieldy program. All the charts and explanation are for the purpose of helping the contractor analyze his own business. After he gets himself properly informed so that he knows what he is doing, he can boil his estimating down as much as he likes.

In good estimating practice many of the items shown in exhibit "A" are set up in the regular estimate as direct job cost. The rest of the items can be condensed into one unit which like labor units are raised and lowered to fit the job at hand. More details will be given with illustrations, in a later article.

Labor Overhead Factors

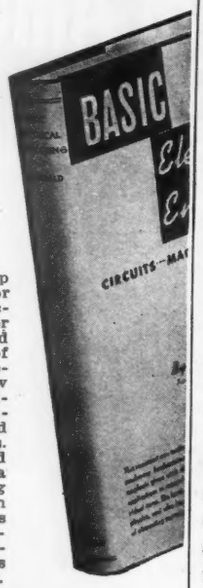
In this article, attention has been given principally to the necessity of estimating overhead for material and labor in accordance with the individual costs of supplying same. No explanation has been offered as to how the figures were compiled. Such an explanation provides an important topic and justifies more space than is allotted here. A future article will discuss details with special attention given to the cost of supplying labor, and labor services.

Electrical living is taking big strides ahead in postwar America—with new homes and new appliances. This means a bigger-than-ever load for wiring . . . and greater-than-ever need to *wire adequately* with PORCELAIN Protection!

The contractor makes more money—and the consumer saves money—with PORCELAIN on the job! This system carries a 33% to more than 100% greater load than any other wiring method—wire size for wire size. This extra capacity assures the home owner more economical installation and operation. Ask your Electrical Inspector about non-metallic knob-and-tube wiring for safety. Write for wiring manual.

NOW . . .

the basic electrical engineering you need in industrial and scientific applications



Here for quick brush-up by electrical engineers or a clear, concise introduction for engineers in other fields, is a direct and fundamental treatment of electrical engineering, presenting an integrated view of circuit theory, electrical-machinery fundamentals and applications, and engineering electronics. The approach is new and well adapted to give a rapid grasp of working fundamentals, from simplest circuit concepts to an understanding of instrumentation and automatic-control applications in research and industry.

Just Published

BASIC ELECTRICAL ENGINEERING

Circuits - Machines - Electronics

By A. E. FITZGERALD
Associate Professor of Electrical Engineering
Massachusetts Institute of Technology

443 pages, 385 illustrations, $3.75

The book begins with the simplest concepts, dealing with circuit analysis, behavior of certain electrical networks, transients, etc. It then goes on to a complete physical analysis of all common machine types, machine performance and applications. Various electronic tubes and circuits are discussed from the industrial, instrumentation, and control viewpoint, and in the last two chapters the treatment of individual items is correlated in a discussion of instrumentation and automatic-control applications in research and industry.

Look up the helpful material given on such topics as: applications of circuit theory; analysis of series circuits; cost considerations and electric rate structures; hysteresis and eddy current losses; three-phase synchronous motor; determination of motor ratings; analysis of generator performance; comparison of high-vacuum tubes; phototube applications; automatic starting of a-c motors; etc., etc.

• See just how this comprehensive modern review of industrial electrical engineering may help you in your work. See a copy of the book 10 days on approval. Simply send this coupon.

McGraw-Hill Book Co., 330 W. 42 St., N.Y.C. 18

Send me Fitzgerald's BASIC ELECTRICAL ENGINEERING for 10 days' examination on approval. In 10 days I will send $3.75, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State.....

Company .....

Position .....EC. 5-46

For Canadian prices write Embassy Book Co., 12 Richmond St. E., Toronto 1

"T" CAN TAKE IT

[FROM PAGE 71]

imately 125 feet long, was built for its storage. Here, the salt is stored in a series of open bins running the length of the shed. The PVC coated wiring, furnishing power to unit heaters and for lighting, is erected in the open directly over the storage tanks. The unit heaters, suspended in the same space, are in a constant state of corrosive deterioration in spite of regular attention and it has been necessary to replace them at regular intervals. Not so the PVC coated wire.

In the caustic soda processing building, there is a lot of PVC coated wiring in conduits buried in the concrete floor. Considerable difficulty has been experienced here due to action of the caustic soda first on the concrete and subsequently the buried conduits. The soda attacks the concrete, removing the lime from it and causing disintegration. This action works on down through the concrete to the imbedded conduit, which in turn is attacked by the caustic soda. Conduits have been found completely corroded away but the PVC coated wire, enclosed within the conduit, remained in its original sound condition and obviously quite impervious to another destructive action.

The advantage of PVC in the presence of chemicals was shown in two locations, the hydrochloric acid and the sulphuric acid buildings, where two types of insulation were used under exactly similar conditions. Some of the rubber wiring used when this plant was built was installed in these buildings in conduits imbedded in the concrete. At about the end of the first year, corrosive action and moisture in these conduits caused failure of the rubber leads which made their replacement necessary. However, it was found impossible to pull the wiring out of the conduit in many places because, in corroding, it had become welded to the conduit. As a result, the arduous and costly task of breaking up the concrete and removing the conduit was necessary in order to remove this defective wiring. Then followed, naturally, the installing of new wiring and new conduit and the patching of the concrete. Such a replacement as this involves not only a great deal of extra expense and labor but also the loss due to shutdown of equipment. Further, patched up concrete is never as good as the original. The new wiring that went in here was PVC coated and, in the three years since its installation, completely satisfactory service has resulted with no replacement necessary. This resulted under the identical de-

SEARCHLIGHT SECTION

POSITIONS WANTED

EX-NAVY Chief Electrican Mate desires position with manufacturer or sales dep't. of electrical organization. Will take anything in electrical field. PW-369, Electrical Contracting, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL AND Radio laboratory instructor desires position in electrical sales or engineering. 12 years experience as journeyman electrician on construction and maintenance. Married, age 33. Resposible person with ability to organize work. Willing to travel. Alfred W. Rennie, 46 Woodlawn Avenue, Buffalo 8, New York.

FOR SALE

ELECTRICAL CONTRACTING & SALES BUSINESS

This up and going profitable business, successfully operating for over 25 years. Owner in the business for over 46 years in this city. Firm enjoys a broad accquaintanceship, good reputation and also a fine volume of business.

The city is one of the most progressive and fastest growing in the United States and located in Texas.

The owner feels he has worked long enough and wants to retire. The business made this possible. Properly operated it will do as much for you. $30,000.00 will handle the deal.

BO-360, Electrical Contracting
520 North Michigan Ave., Chicago, Ill.

AN EXCEPTIONAL OPPORTUNITY

for the right man capable of taking charge of electrical repair shop in emergencies. Must be thoroughly experienced in AC or DC winding. Top salary paid, plus bonus. Business established 20 years.

THE ELECTRICAL REPAIR SHOP
Hazleton, Pa.

May Special

NEW 3 H. P. MOTORS

Louis Allis Frame 225, 220V.-60 Cy.-3 Ph. 1800 R.P.M. Splash proof. Ball Bearing. Double End Shaft. Tropical Ins. Price each, F.O.B. Rochester, N. Y. **$82**

MOTORS, GENERATORS, TRANSFORMERS BOUGHT & SOLD

For prompt action, wire specifications collect

ELECTRIC EQUIPMENT CO.
63 Curlew Street • Box 51 • Rochester 1, N. Y.

FOR SALE

Despatch armature baking oven, recirculating type. Natural gas fired, double door, with rack on wheels. 3'6" depth; 5'6" length; 5'0" height. Maximum temperature 450° with temperature control.

KATO ENGINEERING
Mankato, Minn.

structive conditions that made the rubber wiring so short lived.

In March, 1945, the Ohio river went on one of its too frequent and damaging rampages, flooding Louisville and the Geon plant with it. The crest of the flood came with the muddy river water swirling against the walls of the first floor. This meant complete submersion of all buried conduits. Accordingly, failures of wiring in these conduits were expected as a result of the flooding but none whatsoever developed. As a matter of fact, there are some areas in the plant where it was felt unnecessary to remove the flood water from the buried conduits. Consequently, there is today considerable wiring functioning satisfactorily in still flooded conduits.

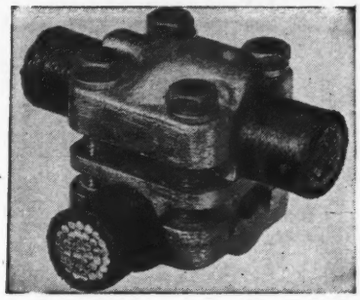
The permanency of color in the wiring is another property quite thoroughly tested at this "laboratory." The severe electrical service conditions present in the plant plus occasional handling with greasy hands soon "blacks out" the identifying colors in the wiring. On wiping off this dirt and grime, the colors in the rubber wiring have been found entirely obliterated in four years' time while the colors in the PVC wiring re-appear in their original glossy state and color. This ability of PVC wiring to retain its color is a valuable asset in complex wiring layouts where simple and ready identification is desirable.

Because of the entirely satisfactory results obtained at Louisville, the B. F. Goodrich Company, of which B. F. Goodrich Chemical Company is a division, is using PVC coated wire throughout two new tire plants now under construction at Miami, Oklahoma and Tuscaloosa, Alabama. While the conditions at these new plants are not as severe as those found at Louisville, a "tough" wire insulation will be necessary and polyvinyl chloride will fill that role without question.

The finer points of motor and transformer repair services are expounded by H. Stewart (center), Westinghouse Electric & Mfg. Co., to W. Ahrendt (right), electric service dept., City of Milwaukee. At the recent Milwaukee EME industrial electrical exposition.

Frankel

RANGE TAPS



Taps two cables at right angles or in parallel and may be used as a TWO-WAY. Only five sizes of this tap cover a full range of cable combinations from 1,000 MCM to 1,000 MCM down to 1/0 to 6. The size illustrated will take 500,000 to 250,000 on main, 500,000 to 1/0 on the branch.

Body of electrical bronze; Everdur hardware; Underwriter approved.

This connector, because of its varied uses and broad size range is invaluable in an emergency—and with only five sizes is easy to stock.

Frankel Solderless Connectors

Catalog 4-C on request

FRANKEL CONNECTOR CO.
27 VESTRY STREET · NEW YORK 13, N. Y.

Get This Complete Data on Selling Guth Germ-Killing LIGHTS

NO PRIORITY NEEDED! QUICK SHIPMENTS!

GUTH Germ-Killing Lights provide you with one of the best profit-building opportunities in the whole industry! Every school, office, restaurant, and public building—as well as dairy, horse and poultry farms, food processors, meat markets, etc., are *all* potential buyers.

We have pioneered in designing and building *Germ-Killing Lights*, and our experienced engineering service is bound to help make selling easier for you.

Write today for detailed Bulletins on GUTH Germ-Killing Lights. They are packed with real, usable information to help you sell.

GUTH GERM-KILLING LIGHTS
Work More Effectively than a Surgeon's Mask

Guth

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

Advertising In This Issue

★Accurate Mfg. Co. 119
Acme Electric & Mfg. Co. 39
★Adam Electric Co., Frank 81
Advance Transformer Co. 166
★Aerovox Corporation 134
All-Bright Electric Products Co. 49
★Allen-Bradley Co. 113, 114
★Allis-Chalmers Mfg. Co. 5, 7
★All-Steel-Equip Co. 8
Aluminum Co. of America 92
★American Steel & Wire Co. 104, 105
American Telephone & Telegraph Co. 36
★American Transformer Co. 14
★Anaconda Wire & Cable Co. 56
★Appleton Electric Co. 2
Armstrong Mfg. Co. 182
Arrow-Hart & Hegeman Elec. Co. 19
★Associated Projects Co. 166
★Austin Co., M. B. 46
★Auth Electrical Specialty Co. 151
Automatic Elec. & Mfg. Co. 172

Bakelite Corp. 17
Bell Telephone System 36
★Benjamin Elec. Mfg. Co. 96
★Biddle Co., James G. 179
Blackhawk Mfg. Co. 140
Brady Company, W. H. 160
★Briegel Method Tool Co. 154
★BullDog Electric Products Co. 146
Bunting Brass & Bronze Co., The 37

Camfield Mfg. Co. 28
Century Electric Co. 101
Certified Ballast Mfrs. 135
★Champion Lamp Works 128
Chase-Shawmut Co. 144, 145
★Chicago Transformer Corp., Division of Essex Wire Corp. 171
Clark Co., Robert H. 174
Clark Controller Co. 121
Crescent Ins. Wire & Cable Co. 120
Crouse-Hinds Co. 6
★Curtis-Lighting, Inc. 133

★Day-Brite Lighting, Inc. 124

★Efficiency Elec. & Mfg. Co. 110
Electric Equipment Co. 184
Electric Repair Shop 184
Employment 184

★Fairbanks, Morse & Co. 103
Federal Electric Products Co. 122
Federal Telephone & Radio Corp. 43
★Feedrail Corp. 16
★Frankel Connector Co. 185
★Fullman Mfg. Co. 173

Garden City Plating & Mfg. Co. 172
★Gedney Electric Co. 180
★General Electric Co. (Bridgeport) Back Cover, 26, 42, 169
★General Electric Co. (Nela Park) 129
★General Electric Co. (Schenectady) Inside Front Cover, 9, 10, 11, 13
General Luminescent Corp. 162
Goodrich Chemical Co., B. F. 48
Goodrich Electric Co. 130
Grain & Feed Mills Co. 184
★Graybar Electric Co. 58
★Greenlee Tool Co. 165
Guth Co., Edwin F. 185

★Hazard Ins. Wire Works 51
★Holdenline Company 127
★Hullhorst Micro Tool Co. 164
(Div. of Toledo Standard Comm. Co.)

★Ideal Industries, Inc. 54
★Illinois Electric Porcelain 40
★Ilsco Copper Tube & Products Co. 174
★Insulation & Wires, Inc. ..33, 107, 108
International Tel. & Tel. Corp. 43
★Irvington Varnish & Ins. Co. 123

★Jefferson Electric Co. 116
Jenkins Bros. 20
★Johnson Bronze Co. 110

★Kato Engineering Co. 180, 184
★Killark Elec. Mfg. Co. 21
Kirkland Co., H. R. 182
★Klein & Sons, Mathias 163
Kondu Corp. 148
Kuehl & Son, D. S. 182

Lau Blower Corp. 12
★Leader Elec. Mfg. Corp. 15
★Lighting Products, Inc. 137
Lloyd Products Co. 167

★McGill Mfg. Co. 126
McGraw-Hill Book Co. 174, 184
Mell-O-Chimes 164
★Mercoid Corp. 162
★Metropolitan Device Corp. 1
Miller Co. 131
★Mitchell Mfg. Co. 94
Monarch Fuse Co. 177
Multi Electric Mfg. Co. 178
★M & W Electric Mfg. Co. 170

National Elec. Products Corp. 86
North American Electric Lamp Co. 172
Nu Tone, Inc. 24

★Okonite Co. 51
★Onan & Sons, D. W. 156
★O. Z. Electrical Mfg. Co. 25

★Paine Co., The 178
Paragon Electric Co. 149
★Paranite Wire & Cable Corp. 23
Pass & Seymour, Inc. 176
★Pelham Elec. Mfg. Corp. 181
★Penn-Union Electric Corp. 178
Pittsburgh Reflector Corp. 4
Porcelain Group 40
★Porcelain Products, Inc. 40, 183
Pryne & Co., Inc. 154
★Pyle-National Co., The 115

★Quadrangle Mfg. Co. 150

Reading Electric Co., Inc. 168
★Reliance Automatic Lighting, Inc. 168
Republic Steel Corp. 30, 31
★Revere Elec. Mfg. Co. 180
★Ridge Tool Co. 32
★RLM Standards Inst., Inc. 143
★Rockbestos Products Corp. 44
★Roebling's Sons Co., John A. 90, 91
★Roll-A-Reel 178
Rose, E. D. 132
Royal Electric Co. 175
★Rusgreen Mfg. Co. 172
★Russell & Stoll Co. 118

★Sangamo Electric Co. 152
Sav-U-Time Sales Company 136
Searchlight Section 184
★Sherman Mfg. Co., H. B. 134
★Simplet Electric Co. 160
Simplex Wire & Cable Co. 138
Smith Iron Works, A. L. 45
★Sorgel Electric Co. 161
★Spang-Chalfant, Div. of the National Supply Co. 41
★Specialty Porcelain Works 40
★Speer Carbon Co. 156
★Square D Company Inside Back Cover, 35
Steel & Tubes Div. 30, 31
★Superior Carbon Prod. Co., Inc. 112
Superior Insulating Tape Co. 80
Syntron Company 170

Thomas & Betts 27
★Toledo Pipe Threading Mach. Co. 157
★Toledo Standard Commutator Co. 164
★Tork Clock Co., Inc. 182
Trico Fuse Mfg. Co. 112
★Trumbull Electric Mfg. Co. 141

★United States Rubber Co. 29, 88
★United States Steel Corp. 104, 105
United States Treasury Dept. 50
★Universal Clay Products Co. 40

Virden Co., John C. 82

Wagner Electric Corp. 18, 109
Wakefield Brass Co., F. W. 38
★Ward Leonard Elec. Corp. 170
★Ware Brothers, Inc. 111
★Westinghouse Elec. Corp. (Lighting Div.) 79
★Wheeler Reflector Co. 155
Where To Buy 182
Wiremold Company 34
Wodack Elec. Tool Corp. 182
★Wurdack Elec. Mfg. Co., Wm. 47

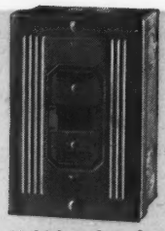
Young Brothers Co. 22
Youngstown Sheet & Tube Co. 158

★ These companies have supplied additional buying information on their products in the 1946 edition of the Electrical Buyers' Reference

Wherever you need...
OVERCURRENT PROTECTION

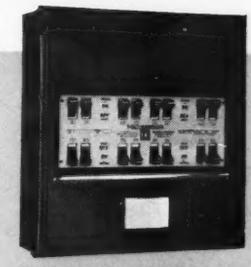
You save time and money with Square D Circuit Breakers

Weatherproof, Dust-Tight and Explosion-Resisting Circuit Breakers.



MO Multi-breaker for use on small machines.

Industrial Circuit Breakers in standard sheet steel enclosures.



Multi-breaker Load Centers for controlling and protecting lighting and small power circuits.

Rain-tight Multi-breakers with a variety of circuit arrangements.

Industrial Multi-breakers in capacities from 15 to 100 amperes, with 2 or 3 poles.

Multi-breaker Load Centers in Cast Iron Enclosures for Class 1, Group D and lower applications.

Multi-breaker Type M Load Centers with 50 ampere frame breakers for applications involving 120-240 volt AC circuits.

HERE'S HOW YOU SAVE TIME...

1 *Harmless momentary overloads pass without breaking the circuit, due to a time-lag feature built into every Square D Circuit Breaker.*

2 *Restoration of service is quick and easy. No replacing of fuses. A simple movement of the operating lever restores current after the cause of the short or overload has been eliminated.*

HERE'S HOW YOU SAVE MONEY...

1 *Fuses are eliminated—no replacement of parts is necessary.*

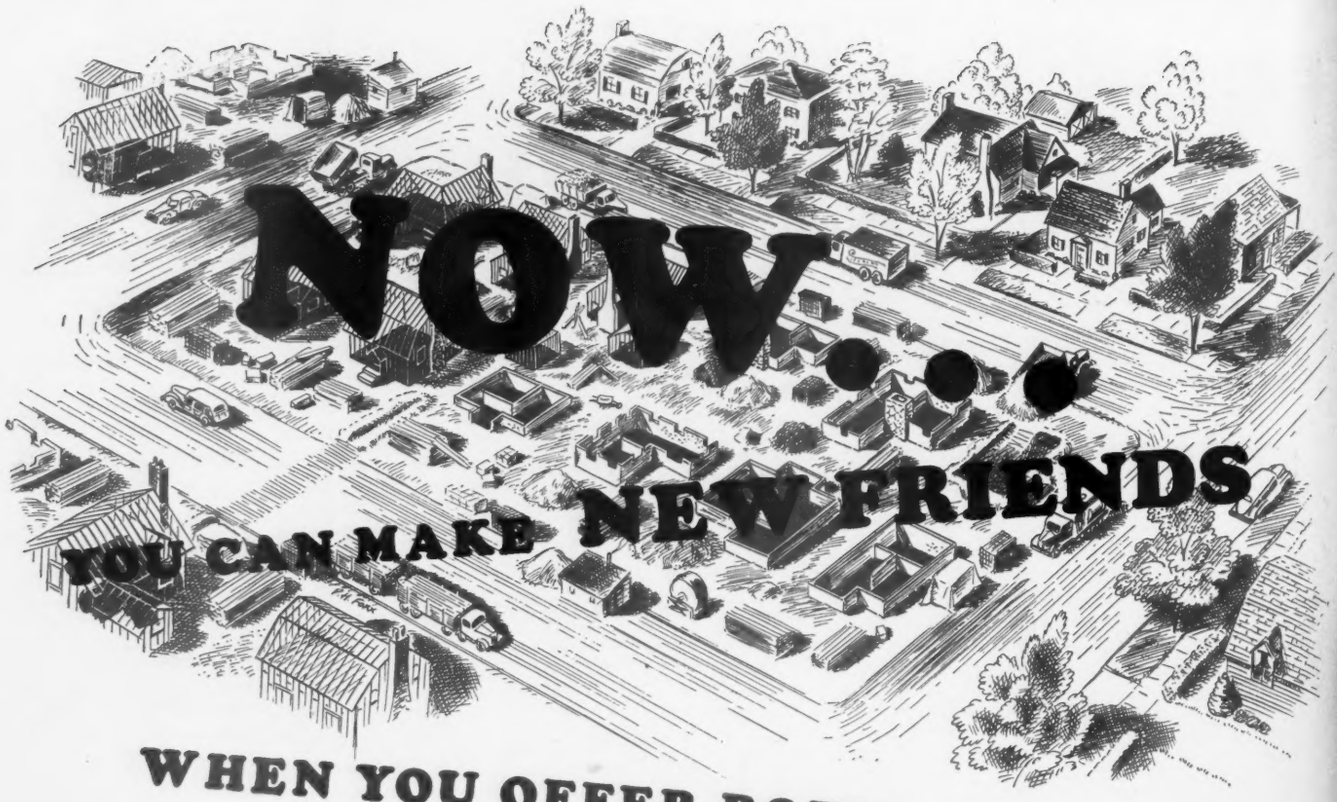
2 *Electrical equipment has constant proper protection, because every Square D Circuit Breaker unit is factory-sealed and consequently tamper-proof.*

Square D makes exactly the Breaker you need

• Square D's *complete* line enables you to select exactly the right device for any given installation. A wide variety of enclosures, including general-purpose, raintight, dust-resisting, and explosion-resisting. Capacities range from 15 to 600 amperes, up to 600 volts. Send for INDUSTRIAL CIRCUIT BREAKER BULLETIN which illustrates and describes the complete line.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



WHEN YOU OFFER BOTH

PVX* *the new G-E nonmetallic sheathed cable*

FLAMENOL* *building wire—for modern wiring requirements*

General Electric's new PVX nonmetallic sheathed cable is an added selling tool for you. When you offer *both* PVX and Flamenol, Types T and TW building wire, it means better service for your customers and new friends for you.

Flamenol building wire and PVX cable can be used for both open and concealed work in residential and commercial buildings. They have many advantages that contribute to easy installation, great resistance to hazards encountered in service, and long life. Check these features today — and start building for tomorrow's bigger sales.

PVX

PVX is a new high-quality, lightweight, small diameter cable assembly that can be installed quickly and easily, and will give long service. Insulation of the Flamenol Type T wires is a thermoplastic compound, high in dielectric and mechanical strength, and resistant to oil, acids, and alkalies. The conductors are protected with an improved crushed-paper armor, and are covered with a tough over-all braid. Both insulation and over-all braid are flame and moisture resistant. The whole assembly can be freely stripped. Available with two or three conductors in sizes 14 to 4.

Types T and TW Flamenol Building Wire

This small diameter, high-quality building wire is available in sizes No. 14 to 2,000,000 CM. It is ideal for new wiring, rewiring, and maintenance wiring. It is easy to pull in conduits, and can be stripped quickly. The insulation of both Types T and TW has long life, is high in dielectric and mechanical strength, and is resistant to oils, acids, and alkalies. Type TW is especially recommended for wiring in wet locations.

For further information, write to Section W561-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Trade-mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC